

CTO

THE MAGAZINE FOR INFORMATION EXECUTIVES

MAY 15, 1992
VOLUME FIVE NUMBER TWELVE
SEVEN DOLLARS

SPECIAL SECTION

STRATEGIC OUTLOOK ON SUPERNETWORKING:

*How To Cure
The Common
Infrastructure*

AN INTERNATIONAL DATA GROUP PUBLICATION

**Health One Corp.'s
Dick Blair**

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CIO

VOLUME 5, NUMBER 12

STRATEGIC OUTLOOK

SUPERNETWORKING

The Big Band Era

An impending explosion of high-bandwidth applications will open a new world of communications possibilities for CIOs willing to invest in the future.

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And CIOs who don't follow the score may find their networks are out of tune.

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Cover photo by Steve Niedorf

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As companies focus on quality, customer satisfaction and the ability to grow and change, they must come up with new metrics for gauging their success. IT can help.

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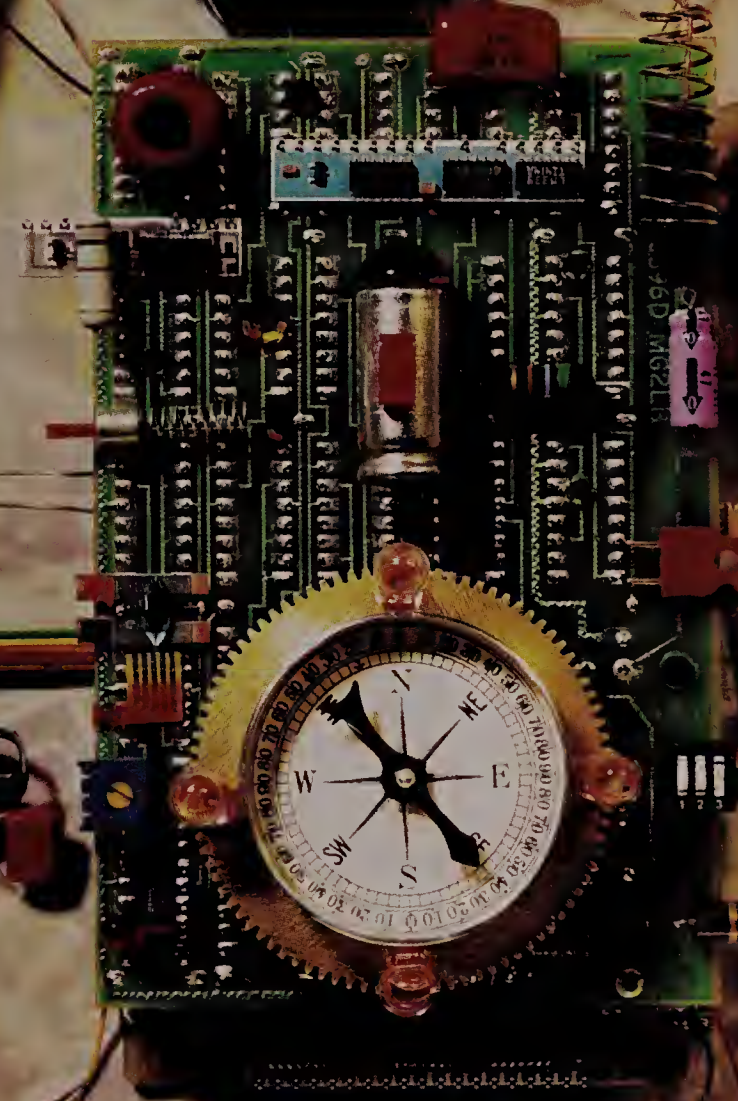


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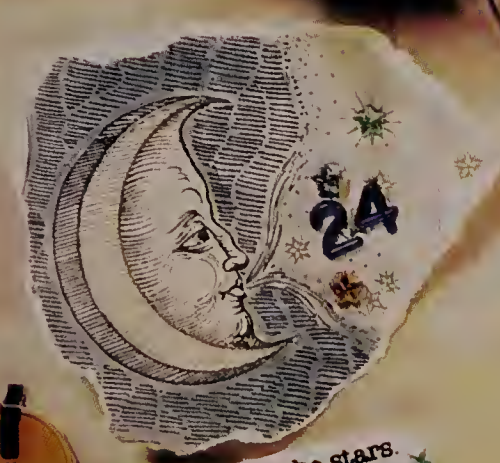


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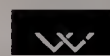
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There's no such thing as a programmer's Hippocratic Oath, but legislatures and professional organizations are making ethics part of the job for computer professionals.

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Our premier column by industry observer Portia Isaacson looks forward to the day when computers will be as ubiquitous, friendly and self-explanatory as telephones and toasters. They'll be the productivity tools of every frontline employee, adding value to organizations and their customers.

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Object-oriented techniques are proving quite effective for developing standard corporate applications. But the real demand for OO technology will explode when companies start to tackle the next, radically different generation of applications.

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The Apple/IBM Alliance

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Dear CIO Reader:

Of all the alliances we've formed over the past years, the one that elicits the most questions is our recently announced alliance with IBM.

This cooperative venture, which stems from a vision shared by Apple® and IBM about the evolution of enterprise computing, is unprecedented in its scope and magnitude. It consists of five technological initiatives that will have far-reaching effects on many aspects of enterprise computing—today and tomorrow.

To familiarize you with these individual initiatives—and to shed valuable light on the alliance as a whole—Apple is offering a special video, appropriately titled “The Apple/IBM Alliance.” In this video, you'll be introduced to the technologies that Apple and IBM are collaborating on and the products that will emerge out of this cooperative effort. And you'll understand in greater depth the potential this alliance has to revolutionize the computer industry, as well as to deliver capabilities that can make your tasks easier now and in the future.

Most importantly, you'll meet key executives of Apple, IBM and Motorola who share their perspectives on what this cooperative venture will mean for you in terms of your enterprise systems today.

In short, our intent in creating the video was to provide you with a conceptual framework with which to view the important milestones that lie ahead.

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Sincerely,

A handwritten signature in black ink, appearing to read "John Sculley". The signature is fluid and cursive, with a large initial "J" and a long, sweeping underline.

John Sculley

John Sculley

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and Chief Executive Officer
Apple Computer, Inc.*





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Editorial Offices CIO Publishing Inc., 492 Old Connecticut Path, P.O. Box 9208, Framingham, Mass. 01701-9208 (508) 872-8200. **Subscriber Services** (800) 788-4605.

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LETTER FROM THE EDITOR



For the most part, *CIO* magazine reflects the critical issues information executives face today in implementing the technologies that will solidify their companies' competitive positions. But every so often it is useful to take a look at what the future holds. Somehow, communications technology lends itself to stargazing.

In this month's Strategic Outlook, Special Projects Editor Allan E. Alter and Contributing Writer David Freedman explore the new capabilities that massive-bandwidth networking will bring to the enterprise. Communications guru Peter G.W. Keen describes the work environment that massive bandwidth will enable as something most executives haven't even thought about yet.

Networks with large-bandwidth capability will make videoconferencing and multimedia applications highly accessible — a real boon now that companies are hard-pressed to do more with fewer financial and human resources. Not only will organizations be able to reduce travel expenses, but the vision of a true collaborative computing environment, in which geographically dispersed employees are able to work together as though they are in the same room, will become a reality.

While this may sound futuristic, some organizations are already experimenting with massive bandwidth. Health One Corp. is participating in a high-bandwidth pilot run by regional carrier US WEST and a variety of other vendors. In addition to videoconferencing, Health One will be testing applications that permit radiologists to receive medical images at their home terminals and relay diagnoses over the network.

As high-bandwidth capability becomes a reality, information executives will find themselves confronting a new set of problems, largely revolving around network-control issues. A variety of vendors will be providing network services, and networks will be open to customers, suppliers and employees working outside the organization.

On another tack, *CIO* welcomes columnist Portia Isaacson to our magazine this month. Portia, a well-known commentator on the computing scene, is currently the president of Dream IT of Cambridge, Mass. Her column, "Frontline" (see Page 62), discusses new information technologies that let people work close to the customer. Appearing several more times this year, Frontline will keep our readers up-to-date on the IT trends that are influencing the marketplace. Portia is looking forward to a lively dialogue with our readers and welcomes your comments.

Marcia Blumenthal

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A Chair The E

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WHEN CLIENTS SPEAK, WE LISTEN.

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As reported in the Strategic Outlook section of this issue of *CIO*, high-bandwidth data-transmission technologies are paving the way for explosive growth in videoconferencing, multimedia, collaborative computing and other applications. A whole new world of communications possibilities and bottom-line business benefits is opening up for those CIOs willing to take the time to learn about emerging high-bandwidth technology options and the applications which exploit them.

Communications-technology marketers who want to ensure the full optimization of these "supernetworking" technologies have a challenging and important missionary job ahead of them. While technologies such as ATM (Asynchronous Transfer Mode) and BISDN (Broadband Integrated Services Digital Network) hold considerable potential for CIOs, marketers must demystify the acronyms and make plain the business benefits. In addition, CIOs will need help cost-justifying the investment required to take advantage of these new developments.

Applications marketers have an equally important role in the education process. While new high-bandwidth technologies provide the medium for faster transmission of more types of data, the ultimate productivity and business benefits will be gained through the applications themselves, whether they are voice-, image- or data-based, or a combination of these.

CIO offers a unique forum for educating information technology executives about the business benefits of supernetworking. And IT marketers who can help with this task are sure to capitalize on the imminent groundswell of interest in these new technologies, while providing a valuable service to CIOs who need to get up to speed quickly.

Walter L. Woz

P.S. Registration is well under way for the next CIO Perspectives Conference, "The Process of IT: Organizing for Success." Please plan to join Lester Thurow, Robert Fulghum and your peers Oct. 11-14, at the Boca Raton Resort & Club in Boca Raton, Fla. Additional conference information is available by calling 800 366-0246.

Coming In CIO

Strategic Outlook: Measuring IT's ROI

Traditional financial measures are poor yardsticks for the intangible costs and benefits of IT, but technology boosters can offer little hard evidence to support the strategic value of their pet projects. What CIOs need are concrete measures they can use to estimate the value of technology, stemming from the strategic goals of the organization and the palpable business needs of customers. *CIO* explores several emerging methodologies that address this new vision of value.

A Mature User

Its membership may be getting on in years, but the American Association of Retired Persons isn't lacking in young, exciting technologies. GUIs, OOPs, multimedia, optical disks, CD-ROM, fiber optics and satellite communications are a few of the technologies in AARP's future, all geared to support the largest membership organization in the country.

Education of a Line Manager

Walt Coleman, vice president of consumer services operations at Whirlpool, says he had just enough knowledge of IT to get him into trouble when he set out to develop and implement a one-call customer-service hot line. The project turned out to be a baptism by fire.



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TRENDLINES

UNPLUG THAT SOLDERING IRON

Some boys had their dogs. Others had their Heathkits. We suspect a lot of *CIO* readers first whetted their IT appetites on the do-it-yourself electronics of the Heath Co., of St. Joseph, Mich., whose obituary ran recently in *The New York Times*.

According to the *Times*, Heath was founded in Chicago in 1926 by former stunt pilot Ed Heath. Its first product was an airplane kit (Heath perished in a crash while test-flying one of them). After his death, new investors moved the company to Michigan. The first electronics kit—an oscilloscope—was introduced in 1947 for \$39.95.

Many Baby Boomers learned to solder while assembling Heathkits. *CIO* Senior Writer Tom Kiely recalled having burned himself “more than once,” and having strained to interpret schematics that left him in doubt as to whether the “right diode was going into the right slot.”

Part of the thrill of building a Heathkit lay in the moment of truth—ei-



ther the thing would work or it wouldn't.

The *Times* quoted Heath President William Johnson about the radio he built as part of his “executive initiation” upon joining the firm: “When it actually played, I ran next door and woke up my neighbor and said, ‘Look what I did.’”

In the article, Johnson attributed Heath's closing to society's growing intolerance of delayed gratification. He also noted that in order to survive, Heath had to offer its kits at prices that were as much as 30 percent lower than those of assembled products—a price point that became steadily more difficult to achieve. ■

LICENSE TO THRIVE

The corporatewide software license, a rare beast today, will propagate to the level of 20 to 25 percent of the Fortune 1,000's network software by 1996, according to a recent study by Forrester Research Inc. in Cambridge, Mass. Vendors so far have shunned such licensing for fear of losing income,

but widespread customer dissatisfaction with current licensing schemes will motivate vendors to make amends by offering corporate licenses.

The old software license models have been rendered obsolete by today's networked environments. It is inappropriate to buy a license for

TELECOMMUNICATIONS

THE HECKLED BAND

Most telecommunications and IS experts are enthusiastic about the prospect of swapping image and other bandwidth-intensive data via high-speed networks. But a few remain cautious, if not outright skeptical.

“If I were a CIO and someone in my department started playing around with multimedia, I'd fire them,” said Lee Goeller, president of consulting firm Communications Resources in Haddonfield, N.J. “Do you really need video games to increase productivity?”

Goeller believes that high-bandwidth communications and its attendant applications will eat up lots of money and provide little in return. “It's a fad, like CB radio,” he said. “We've seen this sort of thing happen over and over again. Organizations always have ways of creative book-keeping to show that a technology is making or saving them money, but the truth is we already have an enormous amount of bandwidth sitting out there that no one has figured out what to do with.”

Harvard Business School Professor Shoshana Zuboff also contends that businesses

are making a mistake by focusing on high-speed networks, if only because that preoccupation could distract them from more important questions.

“There is a tendency to be so enamored of the technology that you start to think that's all there is,” she said. “That's just a form of escapism, a way of doggedly defending ourselves from the human and organizational implications. The really hard question is, is there some way to use networks to increase opportunities to add value to the business?”

Zuboff believes managers have consistently failed to correctly answer that question, and she thinks that, absent a reordering of priorities, high-bandwidth networks may just perpetuate the problem.

“Unless we simultaneously invest resources in the people so they can learn from the technology and change the power structure [and ultimately] act on what they discover, we'll find with networks the same thing we found with automation in the second half of the 1980s: It won't yield the value we hoped for.” ■

every computer on a network, according to Stuart Woodring, the study's author. And without good tools to track licenses and software use, “it's unrealistic for vendors to think users can comply with the letter of the license,” he said.

Woodring is betting that one aggressive vendor, perhaps Borland

International Inc., will lead the way and begin offering corporate licenses as a way to sway big purchase decisions. Other vendors will be forced to follow suit. Ultimately, once corporate licenses take hold, pricing levels will dip and vendor-customer bonds will grow more solid and long-term. ■



"Memorial Day weekend, 1991. I was home, relaxing, having a good time. Little did I know that back at the office trouble was brewing." Last year, lightning struck the air conditioning at

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TRENDLINES

LAW AND TECHNOLOGY

E-MAIL PRESERVATION: PROS AND CONTRAS

Should E-mail messages be relegated to oblivion or accorded a place in the archives of history? This question is at the center of yet another case involving the legal ramifications of computer technology.

According to a recent *Wall Street Journal* article, the Bush administration is battling historians, librarians and public-interest groups in court over the fate of E-mail

records from the White House. Specifically at issue are messages from John Poindexter, Oliver North and other high-level Reagan-era staffers that are stored on backup tapes. While these messages may seem innocuous taken out of context, when examined against the backdrop of the Iran-Contra affair they assume historical significance—and possibly damaging implications.

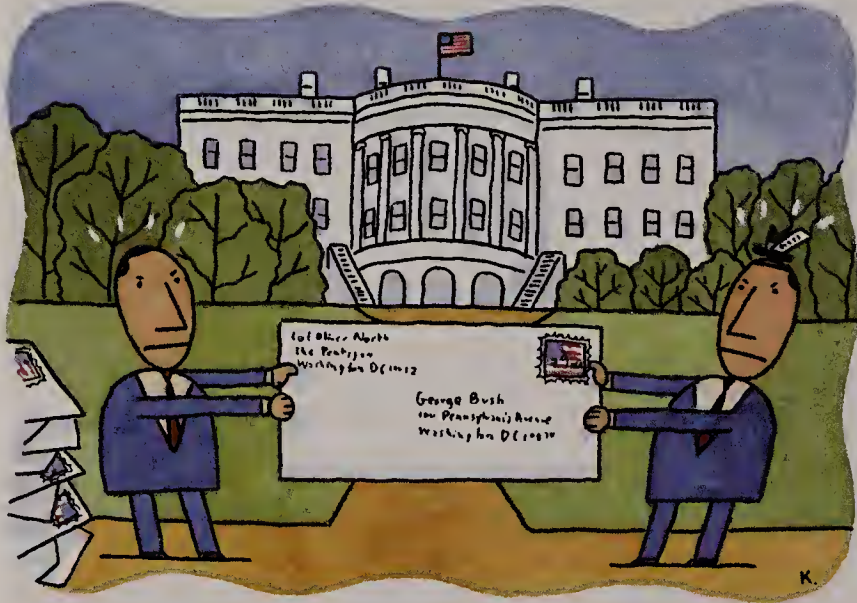
The administration wants to wipe out the tapes, including 98 that contain thousands of messages of unknown content that circulated among the Iran-Contra players. Court opponents claim that such an action would violate the Federal Records Act, requiring the preservation of government documents for posterity.

Administration lawyers contend that E-mail notes are electronic "buck slips" that simply take the place of phone calls, which have never been preserved. Searching through the tapes, which contain 7.3 million pages of text, for matters of historical import would be unreason-

able, they argue. Besides, White House E-mail users are already obligated to print out and preserve all important messages.

E-mail is used throughout the highest levels of government. Presidential historians are worried that if the tapes are destroyed, the archival record of decision-making in the Bush administration will be thinner than any in the modern presidency. At least one historian said that destroying government documents smacks of a cover-up.

It is now in the hands of the court to decide whether E-mail messages constitute history or mere electronic effluvia. ■



CIO CHAT

A CIO lonely-hearts club it's not. But for technology decision-makers who want to kick around a few ideas online, International Computer Negotiations (ICN) Inc.'s network ICNet may be just the thing. ICNet provides an online, interactive forum for discussing technology-procurement strategies and other IS-related problems and solutions. Informal polls, classified advertising and online contract review by ICN analysts are some of the other uses the firm envisions for its network.

According to the Winter Park, Fla., company, 80 percent of the Fortune 500 already make use of ICN's workshops and newsletters to get an edge on negotiating technology purchases and leasing contracts. The network provides them with a venue for exchanging information on pricing, buying or selling computer equipment.

ICNet is available for 30-day free trials. After that, it will cost \$595 annually. The company can be reached at 407 740-0700. ■

WIT'S END

Billy Crystal can rest easy. His job as host of the Academy Awards is not in any immediate danger from humor-mongering CIOs. The response to our joke contest ("Trendlines," CIO, February 1992) was underwhelming—a few titters, a couple of groans—but no real belly laughs. Most of the entries turned on the CIO's obfuscatory use of technology (Q: "How many CIOs does it take to screw in a light bulb?" A: "I'll have to get back to you on that. My distributed open systems and redundant network are all functioning normally but I can't access my EIS frontware because my PC's got an Abort/Retry/Fail?"). Then there were the blonde jokes with "CIO" plugged in (Q: "How can you tell if the CIO has been using the computer?" A: "There's white-out on the screen.") We even had a couple of submissions that were unfit for publication in a family magazine. You know who you are.

Anyway, the winning joke comes from Richard A. Lewis, director of information systems at All-Phase Electric Supply Co. in Benton Harbor, Mich. CIO is not responsible for split sides incurred while reading:

A CIO died and was given his choice of spending eternity in Heaven or Hell. He asked if he could view each before making up his mind. In Heaven, everything was very quiet; people lay around, dozing on clouds and enjoying a perfect summer day. Upon viewing Hell, he saw a wild party: beautiful women, free-flowing booze and everyone having a wonderful time. So he chose Hell. But upon entering the Nether Regions, he found himself in a black dungeon, surrounded by flames and tortured souls crying out in anguish. "This isn't the same place I saw before," he complained to a passing demon. "What happened to the party?" "Oh," replied the demon, "that was just the demo." ■



ILLUSTRATION BY JAMES KACZMAN

Companies all across the country have conquered their fear of outsourcing and learned the truth—outsourcing saves time and money. “We anticipated network growth, so flexibility was important,” said Demo Tsagarakis, MIS Director for Alpha Corporation. “Cost effectiveness in outsourcing our data network included not only data transmission costs but reducing our staff time in

monitoring and managing the network.” Companies have also discovered that the change to outsourcing isn’t as much trouble as they thought: “Making the switch from AT&T to Cylix was no more disruptive to our operations than installing a fax line,” said Robert Smith, IS director for Electrical Insulation Suppliers. And smaller companies have learned

The Talk About Outsourcing.

that outsourcing isn’t just for the big guys: “At first we didn’t feel we were large enough to consider outsourcing. However, selectively outsourcing our data network provides for more time to concentrate on our applications,” said Harold Atkins, corporate secretary of Churchill Truck Lines. When you outsource with Cylix, we manage your data network for you. We order,

install, manage and maintain all communications equipment and leased lines. All for one monthly fee that can save you at least 10% on the operating costs of trying to do it yourself. Get the full scoop on outsourcing. Call us at 1-800-234-2954 and we’ll send you *The Talk About Outsourcing*, a collection of case studies on outsourcing, absolutely free.



The Data Network Experts.

TRENDLINES

ADDING INJURY TO INSULT

In a recent report on National Public Radio's *Morning Edition*, *Atlantic Magazine* Washington Editor James Fallows commented on the danger inherent in the increasing and indiscriminate use of the term "Japan-bashing" to refer to everything from market competition with Japan to outright bigotry. While our current economic conflicts of interest "are not pleasant," he said, "they are normal, and they're not about race...."

"We should be able to discuss rice or semiconductors or even cars without thinking this means hostility to any ethnic group. Each time we de-

scribe these economic complaints as Japan-bashing, we reinforce the false and harmful impression that they are ultimately racial disputes."

Moreover, Fallows argued, "these indiscriminate labels actually dilute the case against real prejudice. Because Japan-bashing is

a catch-all, it masks truly bigoted behavior . . . by lumping it with mere policy dispute.

"When people are prejudiced, let's call them bigots," Fallows said.

"When we have economic disagreements, let's describe them as such. And let's retire the term Japan-bashing before it does us and the Japanese any more harm." ■



RESERVATIONS UN-LIMO-TED

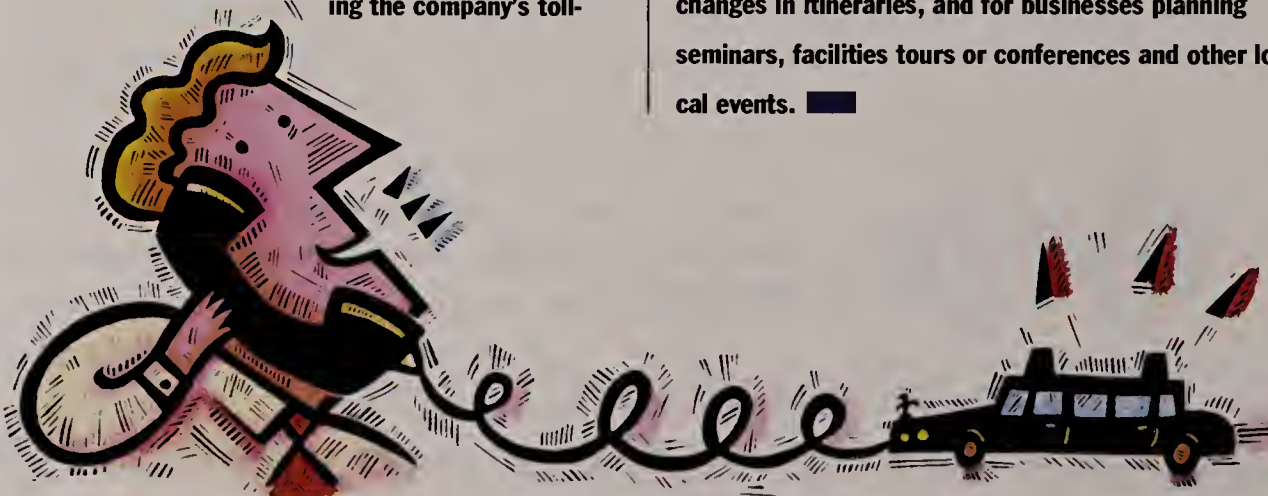
Got a VIP flying into town? Feel uncomfortable telling him to grab a cab at the airport? For times like these, Scarsdale Business Service Bureau offers limousine arrangements without the stretch.

The company's new voice, data and imaging network, appropriately named WE-R-LIMO, links business travelers and other users of for-hire ground transport with local transportation services. Users can reserve and pay for limousine, airport-shuttle, bus-tour or passenger-van services by calling the company's toll-

free line (appropriately numbered 800 WER-LIMO). A small service fee may be added to customers' charges.

Scarsdale has already lined up limousine companies in New York (and surrounding areas), Dallas and Los Angeles. And it plans to expand into 435 metropolitan areas served by commercial airlines, according to S. Robert Perkins, president and CEO of StarMAN Ltd., Scarsdale's parent company.

Perkins says that the service should prove especially useful for travelers facing emergencies and unexpected changes in itineraries, and for businesses planning seminars, facilities tours or conferences and other local events. ■



ONLINE SERVICES

INFORMATION BAZAAR

Buyers and sellers of information and services will soon have a place to meet. The American Information Exchange Corp. (AMIX) will serve as an electronic marketplace for information products and consulting services covering such subjects as computer industry trends and analysis, marketing and management services, products and technical information, software components, and science, politics and art.

Products can include text, graphics, templates, sound and software—anything that can be stored electronically. Prepackaged information can be easily updated and repriced by the seller; it can also serve as a jumping-off

point for more-specific information and customized services or software.

Information for sale is uploaded to the AMIX host computer from the customer's PC and listed in one or more "markets" by subject. Each item includes a descriptive introduction by the seller and comments from previous buyers. Prospective buyers can also refer to the seller's personal resume.

(Early participants include such well-known industry figures as Esther Dyson, Doug Engelbart, Portia Isaacson, Mitch Kapor, Patricia Seybold and Amy Wohl.)

When an item is selected for purchase, the information is transferred to the buyer's PC, the buyer's credit-card account is charged, and the seller is credited for payment. Prices will range from \$10 to \$2,500, with AMIX's cut varying from 10 percent for transactions over \$500 to an average 33 percent for those under \$100.

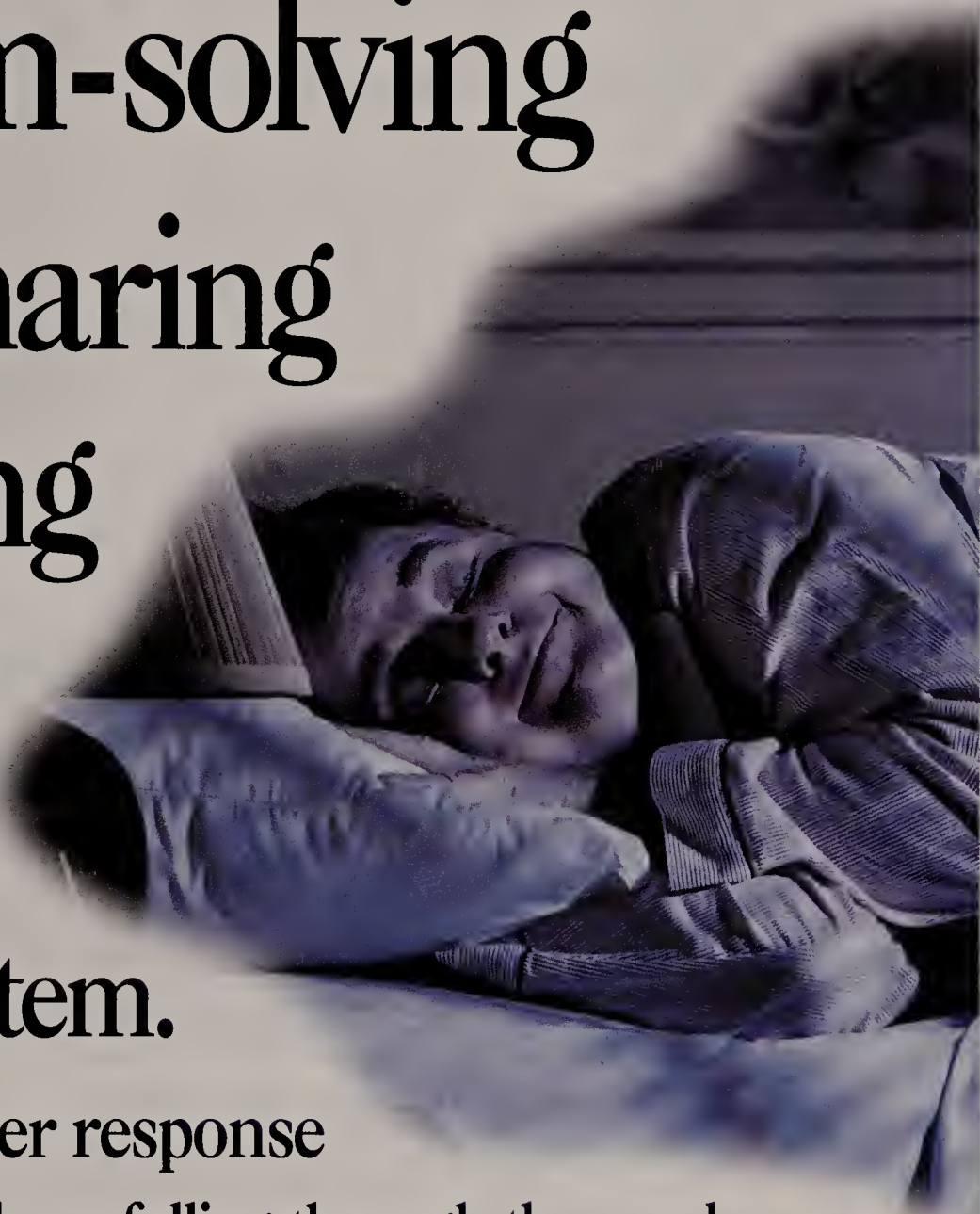
Currently in its "market-building" phase, AMIX, a Palo Alto (Calif.) subsidiary of Autodesk Inc., is expected to open for business within the next few months. For a \$50 sign-up fee, customers receive the service's access software, manual, log-in information and password.

Moreover, AMIX market managers will help sellers market their information. And AMIX will provide technical support at no extra charge.

At launch, nationwide connections are expected to cost \$6 an hour. Access requires an IBM or compatible PC (286+, 12 MHz+) and a 2400-baud or faster modem.

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TRENDLINES

ELECTRONIC COUPONS

CARTS WITH SMARTS

In case the Sunday circulars aren't getting your attention, VideoCart Inc. of Chicago has a better idea: electronic coupons dispensed by your shopping cart. Electronic coupons have a number of advantages over the traditional paper kind, says the company. They require no clipping and saving. You can't forget them at home. And, of more interest to the vendor than the consumer, they

move the product better—an average of 79 percent better, according to recent trials at a Midwestern supermarket.

VideoCart is a special shopping cart that, when pushed through store aisles under a series of electronic sensors, receives preprogrammed messages and displays them on a screen for the shopper.



coupon to the total bill.

The VideoCart system offers manufacturers a timely marketing tool: Electronic coupons provide a short-term, immediate response to competitors' promotions. The system also gathers sales information which helps manufacturers target future pro-

motions by store or region. And manufacturers can keep tighter financial controls by specifying the desired number of redemptions and terminating the offer when that number is reached.

Another significant benefit of electronic coupons is that they promise to reduce the instance of coupon fraud—a rarely discussed, but costly problem in the United States—by making sure that coupon savings only go into effect when the correct product is scanned. ■

When the cart approaches an item for which a coupon is available, a message indicating the brand, product and coupon savings flashes on the screen. Shoppers who choose that product can then push a button to ensure the coupon's value is taken off their final bill. VideoCart stores the coupon information in its memory until the cart enters the checkout lane and then transfers it electronically to the point-of-sale system. After the product is scanned, the computer credits the

MOSTLY CLOUDY, PATCHES OF SUN

Chicago-based Deloitte & Touche's CIO survey for 1992 revealed that CASE is losing its luster, more CIOs expected budget decreases this year, and more IS staff and executives are getting

pressures have come increased terminations. Of those employees leaving application-development jobs last year, 15 percent had been fired, up from 5 percent in 1988. More than one-third of the CIOs surveyed said their predecessors had been booted or demoted.

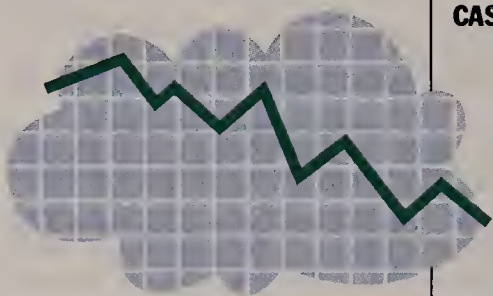
Use of CASE tools is up, but CASE, which was ranked as the best development technique in 1989, came in fifth behind methods such as prototyping and fourth-generation languages.

The survey showed that the CIO role remains strong in the corporate culture: 62 percent of respondents said they are actively developing corporate strategic plans, and 90 percent of these CIOs have their performance measured against the company's profitability. Members of this group saw their average IS budget increase by 3.5 percent, while those who do not participate in the planning process saw an average budget increase of only 1 percent. ■

canned. On the positive side, many CIOs are participating in their companies' strategic planning, and those who do are winning bigger budget increases.

In 1991 IS budgets increased only 3 percent, or 0.4 percentage points less than the rate of inflation. One-quarter of the 430 survey respondents expected a decrease for 1992, up from 20 percent who anticipated cuts in 1991.

Along with the growing budget

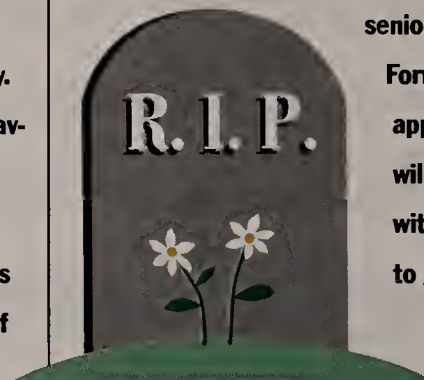


MEMENTO MAINFRAME

The mainframe's days are numbered. We've heard it before and we'll undoubtedly hear it again. The latest poop predicts that only 45 percent of core applications will reside on host machines by 1994, down from 77 percent today. Eighty percent of respondents to a Forrester Research Inc. survey of 75 Fortune 1,000 firms said their interest in downsizing is growing.

At least one mainframe will get the hook at 20 percent of respondent sites, according to the Cambridge, Mass., research firm. One-third of the companies surveyed said they will never buy another mainframe. A majority will continue to upgrade current systems, but at a slower pace.

"Downsizing is white hot," said William Bluestein, a senior analyst of computing strategy research at Forrester. "The mainframe's monopoly grip on application processing is over." Applications will migrate from the mainframe in phases, with decision support leading the pack. Next to go will be aging administrative and business systems, followed by the more powerful transaction applications. ■



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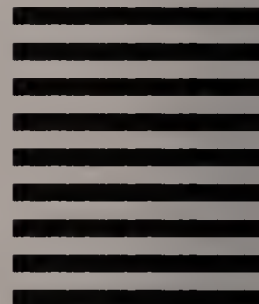
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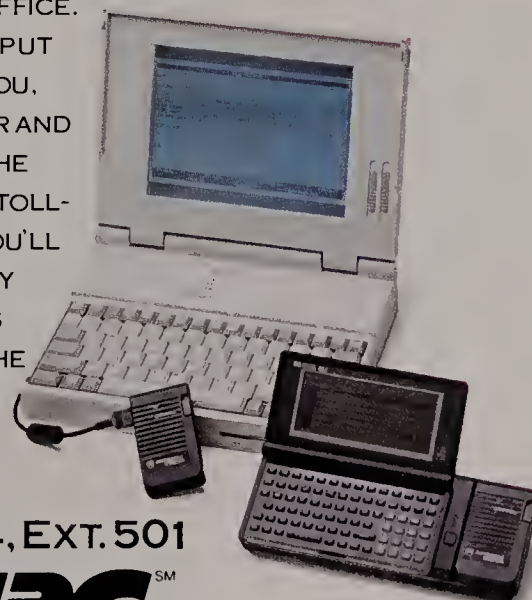
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Do the Right Thing

There's no such thing as a programmer's Hippocratic Oath, but legislatures and professional organizations are making ethics part of the job for computer professionals

BY DON GOTTERBARN

A construction firm building a bridge uses a low grade of concrete in order to finish the project on time and avoid losing money. Lives are endangered. The company is fined and loses its license to operate; someone may go to jail. A computer company programming a pacemaker lowers its testing standards in order to finish the project on time and avoid losing money. Lives are endangered. The law can do nothing.

But that is going to change. At least six states are considering bills that would require the licensing of computer professionals, and there is growing attention to this issue at the federal level as well. Computing companies complain that the states are just looking for another source of revenue. But these bills reflect a drive on the part of concerned users to force minimum skill-level guarantees and adherence to ethical codes

on an industry that has, until now, largely ignored these issues.

Get used to it—ethics is no longer a luxury. So far these bills—from states including California, New Jersey, Tennessee and New Mexico—address only narrow ethical concerns: specifically, contracts and price fixing. But many professional and commercial IS organizations are dealing with broader ethical issues by requiring their members to maximize the quality of software while minimizing any potential harm it might cause.

The Association for Computing Machinery (ACM) has assigned a task force to study proposed revisions to its code of ethics and professional conduct. If adopted, these revisions would oblige IS professionals to reject the old "let the buyer beware" attitude and instead work toward creating superior products and educating users about the principles and limitations of computer systems. The revisions also emphasize the personal development, physical safety, dignity and human fulfillment of all workers.

The proposed ACM revisions are similar to recent changes in the code of ethics of the Institute of Electrical and Electronics Engineers (IEEE). (The Institute's earlier code simply required that its members design systems that cause no harm. The new code, adopted in November 1990, calls on members to anticipate and actively prevent harm, even if the suspected agent is a system designed by someone else. Instead of merely being responsible for their own products, members are now broadly responsible for preventing damage caused by any engineered product with which they are familiar.)

The revisions proposed to the ACM code prohibit the design of systems that could potentially violate personal



privacy, even in small ways. For example, an interactive supermarket videotext system might be able to determine whether a person using the terminal suffers from red-green color blindness (a capability meant to ensure delivery of the best possible color picture to different users). There is nothing unethical about this unless users must identify themselves in order for the determination to be made. If they identify themselves without having been notified that the system collects information about a disability, an otherwise technically sound system acquires an unethical complexion.

Sometimes ethical violations occur because programmers exhibit a kind of technical tunnel vision. Focusing solely on the solution, they fail to consider the well-being of the user. In one instance, a programmer devised an application that would automatically move an X-ray device to any position from the top of its support pole to the tabletop. Shortly after the system was installed at a user site, an X-ray technician asked a patient to get off the table, then keyed the device to descend to the tabletop. The patient moved too slowly and was crushed. While neither the X-ray technician nor the patient were blameless in this accident, the programmer should have had the prescience to install a safety switch. The programmer's goal should have been to protect the customer rather than simply to complete the immediate technical assignment.

Such negligence is understandable, if not excusable, given most programmers' lack of exposure to ethical issues in school or in the workplace. But a concerted effort to correct this situation is already underway in many universities that teach computing skills. As of last year, computer-science departments have been required to include the consideration of ethical issues in computing in their curriculums in order to be accredited. The ACM and the IEEE sponsor such a curriculum, and many universities have already begun incorporating it.

Academia's failure to treat ethical issues is reflected in many corpo-

*Incompetency in
computing is no more
acceptable than
incompetency in
medicine: Both can
cause serious
damage—even loss of
life.*

rations, where it is axiomatic that profit and ethics are incompatible. Unfortunately, computing professionals concerned with this deficiency often lack moral support in the workplace. Everyone wants to be considered a team player, and the object of the team is to increase productivity and revenue. Subjects such as ethics that may prove antithetical to those goals are considered too risky to broach.

To correct this attitude, corporations must create an environment supportive of ethical behavior. This means more than simply having a clearly articulated code of conduct. Codes engender a "checklist" approach to ethics—and perplex employees when they encounter new situations not covered by the list. Also, companies that rely exclusively on codes of conduct may leave employees with the feeling that they are only paying lip service to ethics.

Companies such as Boeing, Raytheon and Texas Instruments have taken a more substantive approach to fostering ethics. In addition to developing codes of ethics, these companies have vice presidential-level ethics officers, and they continuously promote ethical behavior in their employees through weekly newsletters and special training. All new employees receive ethics training from their line managers rather than from some generic training officer—this alone underscores the importance of ethics to new hires.

Boeing established its first ethics committee as early as 1964; today each Boeing division boasts its own

business-ethics department staffed by in-house ethics advisers, and some divisions also have military-ethics advisers. Line managers at Boeing focus on broad principles and issues rather than oversimplified checklists when they conduct their training. Ethical behavior is even a category considered in employee performance reviews. And anyone who is worried that some practice might violate ethical standards can simply call an ethics officer—the number is posted on each employee's phone. The ethics officer will launch an investigation, and if the activity in question is found to be unethical, it is halted.

Boeing provides a model for corporate ethics programs, but it is not unique. Bank of America, Caterpillar, Chemical Bank, Citicorp, JCPenney, Levi Strauss, Stride Rite and Xerox also actively promote ethical training programs, codes of conduct and ethical review committees.

Studies indicate that continuous discussions of ethical issues among peers is the most effective way to teach ethics. Other studies hammer home the conclusion that ethics education does make people more "moral." People want to do the right thing. With the proper training and encouragement, they can.

Incompetency in computing is no more acceptable than incompetency in medicine: Both can cause serious damage—even loss of life. (The next time you are on a plane that is landing in the fog, keep in mind that the only part of the craft that was not developed by a certified professional is the avionics software.) Government licensing can do something toward eliminating such risks, but legislatures must consider more than mere technical proficiency. Licensing programmers without requiring their education in and commitment to professional ethics is like licensing a physician who can treat a contagious disease but sees no reason to inform his patient how to avoid spreading it. ☐

Don Gotterbarn is associate professor of computer and information sciences at East Tennessee State University in Johnson City, Tenn.



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CHANGING THE RULES

As companies focus on quality, customer satisfaction and the ability to grow and change, they must come up with new metrics for gauging their success.

IT can help.



structural reform of the enterprise and new measures of corporate performance aren't yet affecting your IS organization, chances are good that they will be soon. In a growing number of companies, the traditional, strictly financial assessment of performance is being expanded to include such measures as customer satisfaction, business-process competency, and the organization's ability to change and learn. This new and more balanced scorecard for tracking performance is providing many enterprises with the focus and feedback to compete more successfully. Not surprisingly, IT is playing a critical role in developing and implementing these new measures.

The preoccupation with financial measures is a remnant of an earlier period when customers were undemanding, there wasn't a lot of product change, and managers focused on making sure they got their financial results because the operating results were fairly easy to achieve, according to Michael Hammer, president of Hammer and Co. Inc. in Cambridge, Mass. In today's business environments, good operating results are tougher to come by.

"You win by [being] better than your competition at processes that really matter," Hammer said. "What you

need to be measuring are those processes. If what's really important is order fulfillment and I'm better than you at order fulfillment, then I beat you. So a critical issue is identifying your key business processes and determining the right measures of performance for them."

Most organizations rely heavily upon IT for performance metrics, and most corporate information systems have their early roots in the general ledger. The data these systems collect, the information they provide, and the metrics they rely upon for management have grown from those roots. But as techniques for measuring the organization's performance migrate further and further from the strictly financial, the systems become far less serviceable.

The information systems most CIOs manage today quite adequately supported the organizations they were designed for, according to David Norton, president of Nolan, Norton & Co., an information technology firm of KPMG Peat Marwick based in Boston. However, the organizations themselves have evolved since then. "If our organizations are fragmented and structured hierarchically, then naturally our information systems are going to be fragmented and hierarchical," Norton said. "Now that we're trying to change the way organizations function, the systems become a constraint."

"The measures of corporate performance we're trying to build—like quality, cycle time, responsiveness—are cross-functional," Norton said. "[And] they link with customers and suppliers. They're as external as they are internal." When organizations try to extract information that supports these new measures of performance, they often find their systems can't deliver.

The new performance metrics not only measure different things; they're meant to be used differently. "In the past, the emphasis has been on control," said Norton. "You set a target, and then you measured progress ... to that target." But in a world

Plan of Attack

.....
Shell Canada used a team approach to come up with its new performance scorecard

Several years ago, Mike Riley was charged with preparing performance-measurement systems for Shell Canada Products Limited's 19 business units, which account for over \$3 billion of annual revenue and employ 3,000 people. At the time, Shell (headquartered in Calgary, Alberta) was a fully integrated organization operating on a geographic basis. It has since reorganized along functional lines: refining, distribution, marketing, logistics and so on. "Our accounting systems did not support a functional organization," said Riley, manager of reporting and performance management. "In fact, our project was really started to build a new financial-accountability and reporting system."

Riley's task quickly expanded to the creation of a system based on

a more general set of metrics for enterprise performance. "While investigating a new method of management reporting, we inevitably got to talking [with employees] about accountability," he said. "What we heard was that the links between business strategies, objectives, performance criteria and performance measures were not understood; that there was limited congruence of measures throughout the organizational hierarchy or across organizational functions; and that performance measures are often complex, misunderstood and mistrusted. In short, we had the right climate for change."

To engineer this change, the senior managers from each business unit were pulled together to review their respective operations. This team first agreed upon each unit's

where corporations are "trying to have perfect quality, to be responsive to change, to be global, to empower employees," Norton said, "a measurement system can be used as a catalyst—as an agent of change as opposed to a control device to produce conformity." Of course, it's critical to identify what changes to bring about and with what goals in mind.

Calling for reform, however, is not enough; CIOs must ask, "what are the barriers to practicing it?" said Robert Eccles, a professor at Harvard University in Cambridge, Mass., who advises corporations on the issues of performance measurement and organizational change.

One barrier is that much of the information a company needs can only be derived from external sources. Another is the often-proprietary nature of information that has been internally generated. "Whoever has the information, well, it's their infor-

mation," said Eccles. "Senior management can ask for it," but ownership issues may get in the way. "It's a political issue that's a function of the norms and procedures that have developed in the organization over the years."

Pragmatism is essential to any change effort. "The real challenge in all this is finding something that most companies can actually get done," said Robert J. Benson, dean of the School of Technology and Information Management at Washington University in St. Louis. It's nearly impossible for an organization to simultaneously undertake a major strategic-planning effort, develop new performance-measurement criteria, revise how IS responds and reacts to the business side of the organization, and make informed technology-investment decisions.

Avoiding paralysis can be as serious a challenge for the CIO as for



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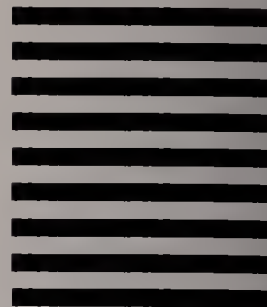
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business planning statement. Then the team decomposed the statements into four elements (financial, customer/market, organizational learning and operations/internal) and carefully reviewed and revised the statements. The result was a performance scorecard for each business unit.

The next step was developing specific methodologies for each performance measure. "The project team brainstormed performance measures, looked at best practices and came up with a prototype, which was reviewed by our functional experts," Riley explained.

After spending nearly two and a half years and the bulk of a seven-figure budget, the team has completed performance measures for all 19 business units. "We are now at the point where we have a briefing book for our senior executives," Riley said. "The book has a single page for every measure and provides each business unit with a strong sense of direction and the tools to measure progress against that direction." —S. Wallace

the organization. To help build momentum, Benson and his colleagues stress that IT investments should be explicitly linked to business goals. "The reason to invest in information technology is to add value to the enterprise," Benson said. Benson advises business managers to make decisions about IT in much the same way they make decisions about any other investments. This approach can be undertaken without an enterprisewide strategic plan or performance-measurement system as the end-point. It can be undertaken even without leadership from senior management. "What it requires is for IT to partner with someone within a business unit who is responsible for performance in that unit," he said. In other words, it's possible to get started without having to incite a revolution.

Howard Rubin, chairman of Howard Rubin Associates Inc. in Pound Ridge, N.Y., agrees that linking IT invest-

ment to business contribution is an important first step for CIOs supporting corporate performance. "That fundamentally means seeing to it that the technology being used is helping the business to prosper, which translates into making money or however the company expresses its goals," he said.

In practical terms, this requires "increasing the yield of the software process, producing more systems and applications and environments that meet or exceed the business expectations," Rubin said. CIOs need to shift their gaze from output to outcome. "In the early days of software, we measured observable things: output kinds of measures like how many lines of code, how many pages of documentation. Output is important at the technical level. But it's more important to start measuring outcome, because you can increase output and not improve outcome."

IS will also have to become more responsive and nimble. "The companies that win in the future will have to be able to concurrently redesign their business processes and the technology, all at once," Rubin said. The thing that will distinguish one organization from another is the ability to adapt. "It's the rate of improvement that's the key, not the rate of movement toward [any particular] target."

It is important not only to improve performance, but to improve performance of the things that matter, and few things matter more than the customer. Customers, both internal and external, can help to identify key measures of success for an organization, advised William E. Perry, executive director of the Quality Assurance Institute in Orlando, Fla. But this approach has its pitfalls. "In a lot of corporations, I think that IS has acted like order-takers, and they haven't gone out and done the market research to know what their customers need," he said. "The tendency is to send systems analysts, who have minimal business training, to help corporations use information to manage. [As a result,]

too many IS directors have the wrong indicators for measuring success; they are not measuring their success by their customers' successes."

If the information needed to start a new performance-measurement sys-

"The measures of corporate performance we're trying to build—like quality, cycle time, responsiveness—are cross-functional. And they link with customers and suppliers. They're as external as they are internal."

—David Norton

tem is just not available, look for surrogate data. "Surrogate does not have to mean haphazard," said Hammer. "If what you need is to measure the accuracy of order fulfillment, you may be able to get by with the frequency of back orders. It may not be exact, but it is certainly highly correlated, and it's easy to produce from your existing systems. And you can generally believe that if one is getting better, the other is getting better too."

If management won't buy into the balanced-scorecard philosophy of performance measurement, a CIO can still orient metrics more toward customer satisfaction—the ultimate source of financial value. "If you're trying to change an organization, to break the gridlock that hierarchies put on an organization, you need some way to bring honesty into the system," said Norton. "Looking at yourself through the eyes of your customers is a way to bring about honesty."

Process Improvement

By establishing strong quality- and performance-measurement programs, IBM Canada has encouraged horizontal, cross-functional orientations and identified opportunities to improve performance and customer satisfaction

IBM appreciates the value of quality. "Quality is an amazing bridge because it is universal in its language," said Thomas F. Corcoran, vice president of communications and quality for IBM Canada Ltd. in Markham, Ontario.

According to Corcoran, the organization has not been shy about incorporating new disciplines or procedures in its pursuit of quality, despite its reputation for spurning anything not homegrown. "IBM is arguably the company that invented [the] 'not invented here' [mentality]," he said. "But we are in transition, embracing ideas developed worldwide and giving them a domestic spin.

"People within our organization have to find their contribution in the value-added chain—in the eyes of the customer—and they have to be able to quantify and develop it." Employees are rewarded for increasing value. The goal is not just to recognize and encourage personal improvement but, more importantly, to identify process enhancements.

Corcoran related an anecdote to drive that point home. "At one Japanese bank, customers were given a token [indicating] whether they had made a cash withdrawal or a transfer between accounts, and [they were] asked to place it in an urn by the door. . . . If satisfied with the transaction, the customer was to put it in the green urn; if dissatisfied in the red urn. Most people on hearing of this experiment think, 'What a great way to measure teller performance.' But no teller identification was included. What was being measured was the process."

Mean-time-to-repair for service calls has been one of IBM Canada's process-improvement efforts. Targets at the national, branch and employee level are reviewed monthly. Each service rep carries a small radio-frequency terminal that transmits repair-activity data to IBM service dispatch centers, leaving a "time trail" throughout the repair cycle.

With the help of classical analysis techniques, the mean-time-to-repair of most of IBM Canada's products has been reduced by almost 50 percent. "This translates into a reduction of 5 million hours of 'wait time' for our customers," Corcoran said. "The bottom line: a big 'value add' for our customers, the potential to apply IBM service resources to . . . customer satisfaction or to revenue tasks, and a round increase in service-rep morale as measured on annual surveys." Such dramatic win-win outcomes are a hallmark of well-executed process-improvement initiatives.

—S. Wallace

"IBM is well known for their annual survey of customers. They'll have a market-research firm talk to their customers blind to ask their impressions of the vendors supplying hardware and software and ser-

vices. This shows how they stack up to their competitors. It's pretty hard to argue the results, because it's objective information coming from the outside."

Perhaps a CIO has confidence in

the development agenda in hand, but resources are scarce. "Budget constraints are a symptom that the IS group hasn't done its job right," observed Perry. "If IS goes and finds out what's needed to make the business successful, they're not going to have a budget problem." Perry noted that corporations that are in bad financial straits will spend \$500,000 to bring in a consultant—if that will help make them successful.

"The rate of improvement is the key, not the rate of movement toward any particular target."

—Howard Rubin

A CIO can make a substantial contribution to change and improvement by keeping a business focus. "A CEO of a company couldn't give a damn how many function points you produce per cubic foot of office space," said Rubin. "The issue is really are you delivering valuable things that [the company] needs and that allow [it] to prosper. . . .

"There isn't a standard template," Rubin added. "Each company has its own drivers, the things that distinguish it in the market and give it a competitive edge." The bottom line: "Measurement programs for an organization have to be custom-designed."

The tools and techniques of IT, while far from perfect for this task, are still the best means available to analyze, document and design performance-measurement systems. And the CIO, whatever the organizational constraints, is ideally positioned to support this process. ☐

Scott Wallace is an independent industry analyst and journalist in Warwick, Mass.

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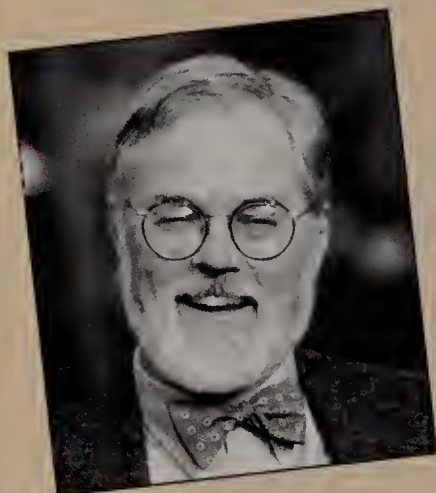
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SUPERNETWORKING

THE HIGH ROAD TO HIGH-BANDWIDTH COMPUTING

These days, when people say they're yearning for big bands, they're not being nostalgic; they're talking about serious networking. "The chip revolution didn't dramatically change the way we look at the world," said ICIT Executive Director Peter G.W. Keen. "But with really massive bandwidth, we have the chance to invent products that haven't existed. What's going on in telecommunications makes the 1980s look like a turtle on Valium."

The Big Band Era

The desire to bring videoconferencing, multimedia, interLAN communications and other high-bandwidth applications into corporate networks is creating a demand for data-transmission volumes and rates that existing data highways are woefully inadequate to handle.

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The Band Plays On

The networks of the future will be more difficult to manage, and the security, accuracy and reliability of data will be harder to maintain. CIOs who don't follow the score may find their networks are out of tune.

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Health Care's Band Leader

Like most health-care providers in the nation, Minnesota's Health One Corp. has been hard-hit by competition and skyrocketing costs. It hopes that high-speed, high-bandwidth networking will help improve service and cut costs by making accessible to all its physicians the expertise of a limited number of specialists.

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SUPERNETWORKING

THE BIG BAND ERA

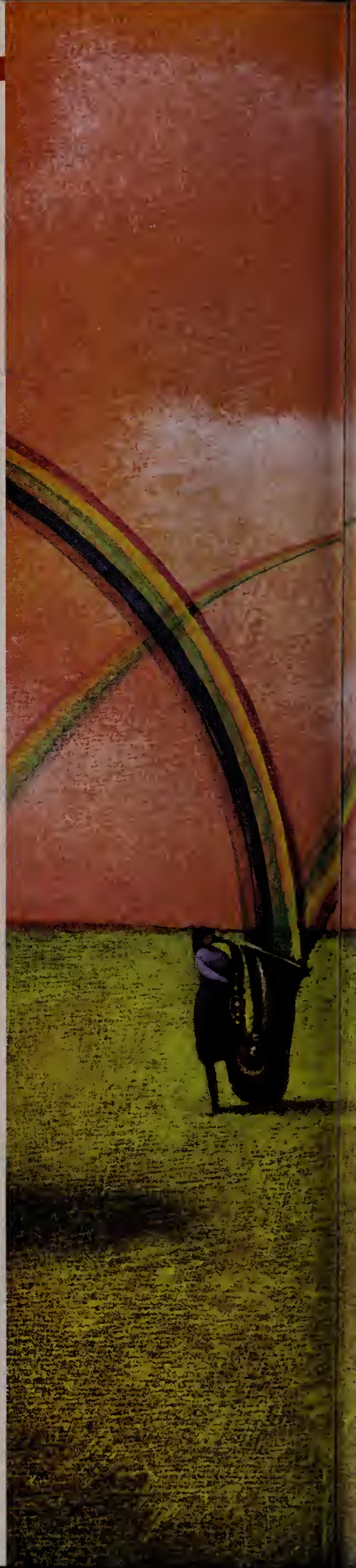
An impending explosion of high-bandwidth applications will open a new world of communications possibilities for CIOs willing to invest in the future

BY DAVID FREEDMAN

You survived the invasion of the PC. You've been handling the demand for cooperative computing with aplomb. Is the tough part over? Get real. Now it's time to embark on a far-reaching transformation of your company's communications infrastructure, thanks to the imminent demand for a quantum leap in data-transmission volumes and rates that existing data highways are woefully inadequate to handle.

These days, when people say they're yearning for big bands, they're not being nostalgic; they're talking about serious networking. "The chip revolution didn't dramatically change the way we look at the world," said Peter G.W. Keen, consultant and executive director of the International Center for Information Technologies in Washington. "But with really massive bandwidth, we have the chance to invent products that haven't existed. What's going on in telecommunications makes the 1980s look like a turtle on Valium."

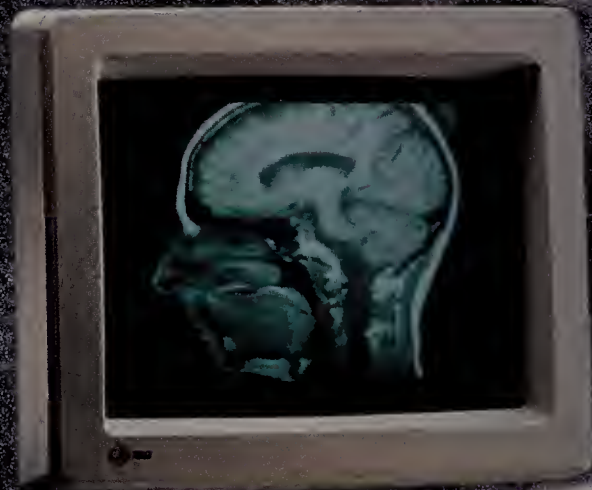
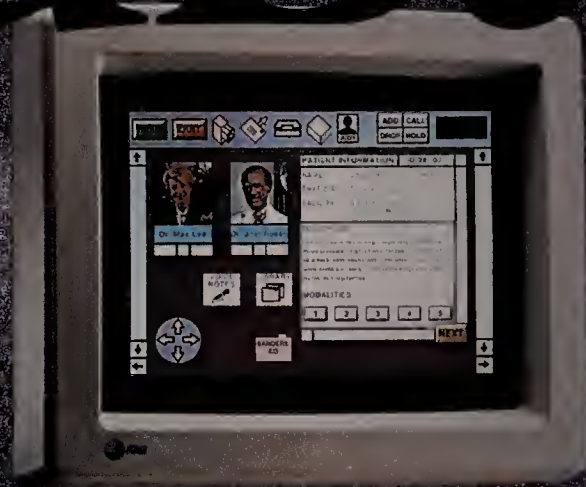
The applications that new, high-bandwidth technology will usher in have been talked about for at least a few years now: video-teleconferencing, multimedia, workgroup computing and collaborative engineering, LAN-to-LAN communications and networked supercomputing, among others. In fact, all of these feats can be accomplished right now over costly, custom-installed, high-speed communications lines. What's new is that a groundswell of interest seems certain to slowly but surely pull these activities into the mainstream, where a few high-speed connec-





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SUPERNETWORKING

tions can't hope to cope. And for these sorts of applications, a standard 56 Kbps phone connection may as well be the Pony Express.

The problem isn't that no one knows how to build cost-effective, high-bandwidth networks. It's just that until now, few organizations recognized the need. "We're talking about capabilities that most companies don't know they have yet," said Clete Gardenhour, senior business planning manager for advanced transmission technologies at AT&T Paradyne in Largo, Fla. "Despite all the complex, high-capacity computing systems they employ, everything gets fun-

neled down to the traditional ways of communicating information when it reaches the network."

The funnel is extremely wide at the top and narrow at the bottom: While conventional copper wires are rarely pushed to rates above 1.5 Mbps, high-bandwidth applications typically require speeds of anywhere from several megabits to a couple of gigabits. In many cases, phone companies haven't been prepared to install that kind of capacity at reasonable time and cost. But that's changing fast.

"Until last year, 99 percent of the communications services were initiated by the

When Less Is More

MIT's pioneering data-compression techniques keep images sharp while easing network demands

Right now sending, storing, retrieving and displaying high-quality images takes relatively huge amounts of network bandwidth, computing horsepower and disk space. But if the MIT Media Lab in Cambridge, Mass., has its way, images will get a lot sharper without overburdening communica-

tions lines.

Though the Media Lab is associated with such glamorous technologies as virtual reality—in which a user appears to interact with 3-D computer-generated images via special gloves and helmets—the lab is also a leader in data-compression techniques. That may sound like mundane work, but to

the Media Lab, compression is just a means to an end; while other groups try to squeeze video onto computers, these researchers are trying to completely blur the line between the two. The results can be spectacular.

At the lab, video display terminals show razor-sharp film clips that have been transmitted

at just a fraction of the bandwidth normally required. To accomplish that trick, a computer digitizes the image and then methodically strips away as much information as possible while retaining the data that is most important to reconstructing the original image. Lab researchers like Michael Bove apply "psychophysics" principles to determine, for example, that moving objects can be blurrier because we don't perceive them as clearly, and that we tend to notice screen "flicker" most in our peripheral vision. ("There's a good evolutionary reason for that," said Bove. "It's so when a rock comes flying at you from the side, you duck.")

Bove insists that the hardware necessary to accomplish these sorts of bandwidth-saving techniques can be packed into computers at little additional cost. All that's required, he said, is for the industry to adopt image-compression standards. And despite the lab's reputation for whimsy, Bove insists that the resulting pretty pictures won't be just for fun and games. "The business applications for this technology are much more important than the entertainment applications," he said. "Everybody in business is looking into multimedia."

—D. Freedman



carriers and we just bought them," contended Frank Dzubeck, president of Communications Network Architects Inc. in Washington. "But a whole new mind-set is developing."

The result is a gusher of alphabet-soup-tagged network offerings that is sure to confound managers. But behind the technobabble names like SONET, FDDI, ATM and SMDS lies a smorgasbord of potential IT-related benefits for organizations. And given that a study by McKinsey & Co. of New York indicates that all the money poured into information technology has yielded an underwhelming 1.4 percent improvement in productivity, what CIO can afford to ignore the upside of the impending bandwidth explosion?

The most immediate applications of high-bandwidth networking include videoconferencing, multimedia, collaborative computing and LAN-to-LAN communications.

VIDEOCONFERENCING

One high-bandwidth application that has already captured many companies' attention is videoconferencing. Sending video images over ordinary phone lines isn't a problem, technologically speaking—witness AT&T's recent announcement of a videophone that can be plugged into a standard wall jack. But the murky and stilted image hits home the inadequacy of 56K for full-motion video. Most experts agree that acceptable quality for videoconferencing begins at several times that rate, and that the image doesn't look really good until you get well into the several- or even tens-of-megabit range.

That's a lot of data highway just to get a look at someone's mug, especially considering the fact that businesses seem to have gotten by just fine with voice communications for most long-distance interactions. But there's a growing conviction that the conventional telephone simply doesn't cut it for important business or technical discussions. "You've got to see all the physical cues," insisted Tom London, head of the computing architectures research department at AT&T Bell Labs in Holmdel, N.J.

Many companies hope that videoconferencing can replace at least some travel as an enabler of face-to-face meetings. There's a powerful incentive to make the switch: Whereas a meeting of 12 managers from geographically dispersed offices can easily run up a \$10,000 bill in travel costs alone—

not to mention the impact of the time away on everyone's productivity—a videoconference might cost only a few hundred dollars.

And then there's the convenience factor. "I don't know about anyone else, but I

THE PROBLEM ISN'T THAT NO ONE KNOWS HOW to build cost-effective, high-bandwidth networks. It's just that until now, few organizations have recognized the need.

spend enough time on planes already," complained Norman Weizer, senior consultant at Arthur D. Little in Cambridge, Mass. "If you could get the job done with a video call, that's the way you're going to do it."

The real trick to getting videoconferencing into the mainstream, say experts, is to shoe-horn it into existing local area networks and right onto the desktop. Apple Computer has already demonstrated passable videoconferencing over its Appletalk LAN, and Fluent Machines Inc. in Framingham, Mass., plans to bring out a reasonably high-quality approach for other LANs. "At least 50 percent of the PCs are already wired up, and LANs usually have the bandwidth you need to implement videoconferencing," noted Dzubeck. "So that's the way to go."

MULTIMEDIA

Videoconferencing might be seen as a subset of multimedia, the broader concept of intimately integrating images—whether still or full-motion, live or pre-recorded, computer-generated or photographed—as well as sound into computing. "Seeing is a much broader-bandwidth way of taking in information than trying to absorb text or numbers," said Peter Blakeney, manager of U.S. operations at IBM in Atlanta. "Images are very concentrated and provide more involvement." Pictures and voice messages could be transmitted by themselves, he noted, or attached to more-conventional applications such as spreadsheets.

Right now, the overwhelmingly popular way to transmit an image over a network is to fax it. But most observers think we can do better. To prove it, Nynex is running a pilot program with several of its large Massachusetts customers that involves transmitting various types of digital images from computer to computer at a variety of speeds.

SUPERNETWORKING

Band Aid

A letter-perfect guide to high-bandwidth technologies

If you want to bring videoconferencing, multimedia, interLAN communications and other high-bandwidth applications into your network, you've got some telecommunications home-



work to do. Most of the high-bandwidth carrier technologies have been developed in the past few years, and many won't be in widespread use for a few years to come. Here's a quick overview of the leading contenders:

ATM (Asynchronous Transfer Mode): A tech-

nique for having a hub at a site parcel out multiplexed bandwidth on demand to a number of lines.

BISDN (Broadband Integrated Services Digital Network): The broadband version of ordinary ISDN, which is already widely considered obsolete for any but the smallest businesses. ISDN specifies a standard for transmitting data, voice and images over copper or fiber wires at up to 1.5 Mbps, suitable for light traffic in still images and crude videoconferencing. BISDN, on the other hand, starts at 45 Mbps and goes up from there.

DS1, DS2, DS3: These phone-company-provided Digital Services carry data and digitized image and voice over standard high-bandwidth lines. DS1 runs over a single 1.5 Mbps T1 line, DS2 uses a T2 line to achieve 6.3 Mbps, and DS3 takes up a T3 line that provides 45 Mbps—the preferred speed for good-quality videoconferencing.

FDDI (Fiber Distributed Data Interface): An optical-fiber-based standard that allows extending a 100 Mbps token-ring LAN to dis-

tances up to 120 miles.

SONET (Synchronous Optical Network): An optical-fiber-based standard that can provide interLAN links at speeds of 50 Mbps and up.

SMDS (Switched Multimegabit Digital Service): A public digital network for interconnecting LANs at speeds of up to 155 Mbps.

All of these high-speed technologies sound wonderful, of course. But they aren't cheap: If you want DS3's smooth-as-silk videoconferencing capacity, for example, it will run you \$30,000 a month—30 times the cost of DS1. Right now, most companies aren't ready to spend that kind of money just to send pictures between LANs on opposite sides of the country.

A large part of the problem is that most high-bandwidth schemes going over all but the shortest distances require optical fiber cables, and that can be a costly option—if it's available at all. "Optical fiber is eventually going to be the right answer for most businesses, but it isn't there yet because of the cost and the difficulty of installation," said Cleve Gardenhour, senior business planning manager for advanced transmission technologies at AT&T Paradyne in Largo, Fla. "Anyone building a new campus environment would probably lay fiber, but we have a heck of a large installed base, and it's going to take a long time before everything gets rewired." Even if a company is willing to pay for a fiber cable, the phone company may be unwilling or unable to promptly install a fiber link from the business to its local switching office. Gardenhour notes, however, that new technologies are pushing up the top speed of copper wire in the interim.

Still, it's clear that for many companies, high-bandwidth networking will have to remain a thing of the future. Well, it's always nice to have something to look forward to.

—D. Freedman

One of the participants is Massachusetts General Hospital, which is experimenting with zipping X-rays and CAT scans almost instantly over networks (see related story, Page 53). (Currently the hospital depends on a 70-person medical-image archiving facility that actually employs a small fleet of busses to relay hard-copy images among the hospital's different locations.) The Christian Science Publishing Society is working with Nynex too, sending production-quality, scanned photographs over the network that runs between its newspaper and television facilities. And at AT&T Bell Labs, scientists and engineers can search for and call up images of any of 15,000 technical memos stored as 25 gigabytes of digital data.

COLLABORATIVE COMPUTING

The ability of teams of people to share images of each other and their work in real time may open up entirely new possibilities for companies whose employees are scattered among geographically distributed facilities.

"With businesses cutting down on their white-collar workforces, they will no longer have the luxury of having complete design teams or people with similar talents at different locations," contended Arthur D. Little's Weizer. "Instead an employee will have a main job and then work on three or four different projects as part of a task force scattered around the globe. Rather than jet-lagging these groups with travel, companies will support them with high-bandwidth communications."

Such groups could be supported with a wide variety of multimedia applications, noted Dzubeck. "If there are 12 of us at different places working on the same project," he said, "and we're all looking at the same spreadsheet, the same graph and the same whiteboard, then we've greatly increased our productivity without ever getting out of our seats." High-bandwidth collaborative capabilities could be especially important to engineering teams, he noted, which often need to share complex blueprints and other diagrams.

LAN-TO-LAN COMMUNICATIONS

As with videoconferencing, most experts believe that existing LANs, with their generally high speeds, provide the appropriate base on which to build high-bandwidth networks for multimedia applications. The problem with relying on LANs, however, is one

of which most organizations are all too aware: Right now it is extremely costly to provide connections between two or more LANs, limiting many forms of information-sharing to groups working at a single facility.

"If you're going along at 10 Mbps on two Ethernet LANs," said Weizer, "you don't

HIGH-BANDWIDTH COLLABORATIVE CAPABILITIES could be especially important to engineering teams, which often need to share complex blueprints and other diagrams.

want to be slowed down by a 9,600K circuit in the middle."

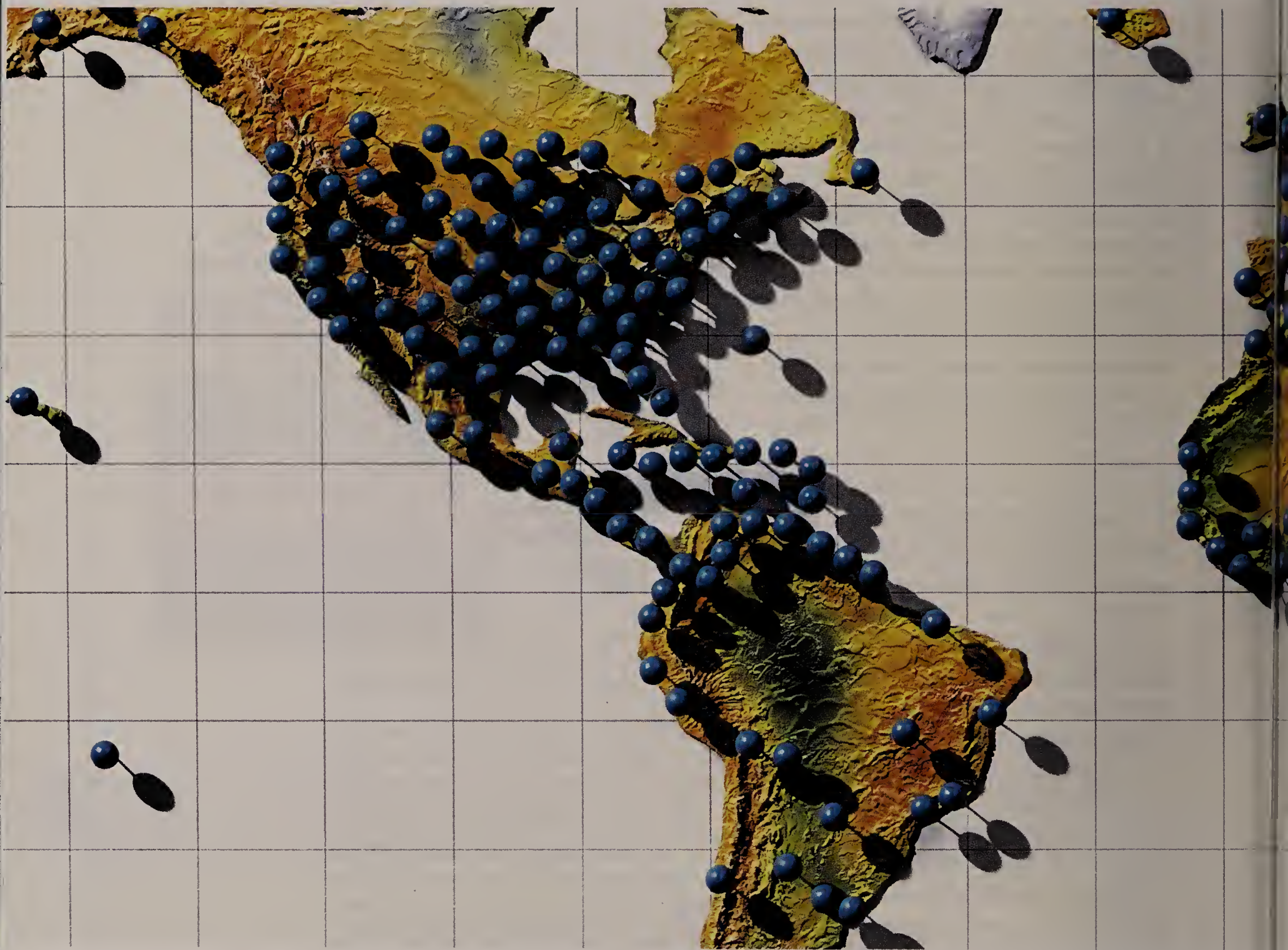
Though full-time high-bandwidth connections are often prohibitively expensive, Weizer noted, a solution is coming in the form of "bandwidth-on-demand" services from phone companies. These services, in which a company essentially rents a high-speed connection for a few moments at a time when needed, will also help organizations deal with such existing LAN-related problems as how to quickly distribute new software to dozens of LANs scattered around the world.

Even batched mainframe applications will benefit, allowing banks and large retail operations to cut down the time it takes branches and stores to send a day's worth of transactions to a central site—time that could be better spent analyzing the data rather than waiting for it. And as the cost of supercomputers plummets, more organizations are interested in allowing engineers to share a single machine over a high-bandwidth network. That's one of the reasons that 3M, for example, is trying out high-speed digital lines between its widely separated facilities.

If nothing else, the possibilities opened up by high-bandwidth technology will give corporate America some interesting new decisions to confront. And that's just the sort of shaking up that businesses need right now, contends Keen. "The extrapolations of current thinking won't get us too far," he said. "We need leaps in creative thinking. Nintendo's Game Boy is more radical than anything going on in corporate America right now." Supernetworks versus Mario Brothers? Cool. **CIO**

David Freedman is a freelance writer based in Brookline, Mass.

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SUPERNETWORKING

THE BAND PLAYS ON

And CIOs who don't follow the score may find their networks are out of tune

BY ALLAN E. ALTER

In the future, networks will be more difficult to manage, but vendors claim they will shoulder most of the burden. Assuming companies forgo private networks for switched services—and everyone we spoke to said that seemed to be the case—“network management will move away from alarms, troubleshooting and trouble-reporting and into configuration management,” said Don Heath, vice president of data marketing at MCI Communications Corp. in Washington. With new services like SMDS (see “Band Aid,” Page 44), network managers will be able (within price structures set by the carriers) to monitor network status from their terminals and configure networks to satisfy bandwidth requirements while vendors handle the headaches of troubleshooting and repairing more-complex networks.

Eventually, networks will reach speeds and levels of complexity beyond the ability of humans to manage, according to researchers at Xerox's Palo Alto (Calif.) Research Center who are exploring ways for networks to configure themselves automatically.

According to Bernardo Huberman, a research fellow at PARC, this capability will depend upon a “free-market mechanism”: When a computer has processing time available, the machine broadcasts that it is free, and programs on the network bid for time on the free computer. The program that wins gets to migrate to the machine.

CIOs will still have their hands full. They

will have to choose from more service vendors and knit together their services as local telephone monopolies give way to competition. And when a company's networks crash, “opportunities for finger-pointing will go up horrendously” because a network based on switched services will be owned by many people, according to David D. Clark, a senior research scientist at MIT's Laboratory for Computer Science in Cambridge, Mass.

CIOs will also have a harder time maintaining control over the network. This may surprise IS executives, since distributed computing would seemingly increase the need for a single person to oversee the network, and CIOs regard maintaining the network infrastructure as a core part of their jobs. But they will have to contend with many centrifugal forces. As corporate networks open up to customers, suppliers and other outsiders, and wireless and cellular communications become commonplace, entry into the corporate network will be accessible to anyone, anywhere.

“How do you control who gets to the information?” said Chunka Mui, the Chicago-based research director of CSC/Index's Vanguard program, an advisory service on emerging technologies.

Users will purchase multimedia applications that put enormous demands on bandwidth, without necessarily notifying the IS department. CIOs will rely on third parties to give their companies' data the TLC it requires. Finally, all these users, customers, suppliers and outsiders—not to mention line



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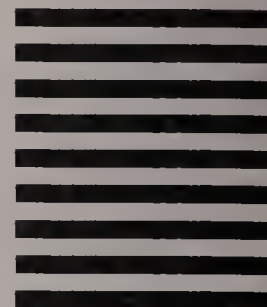
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managers—will want more of a say in, and even some control over, managing the network they've come to rely upon. CIOs may well find themselves battling to maintain control.

It will become both more important and more difficult to ensure the security, accuracy and reliability of data. The tendency of companies toward open borders and increased entry points into the network will make it easier for snoops, whether from inside or outside the company, to steal data and for users to bring inaccurate data into the system.

The speed of these networks will spread inaccurate information, harmful gossip and viruses more quickly through an organization. "If you don't have network and computer security under control, you will be in a real dilemma," said Clark. Users on the network, not just network administrators, will have to worry about security breaches too, as they routinely have more con-

AS CORPORATE NETWORKS OPEN UP TO CUSTOMERS, suppliers and other outsiders, and wireless and cellular communications become commonplace, entry into the corporate network will be accessible to anyone, anywhere.

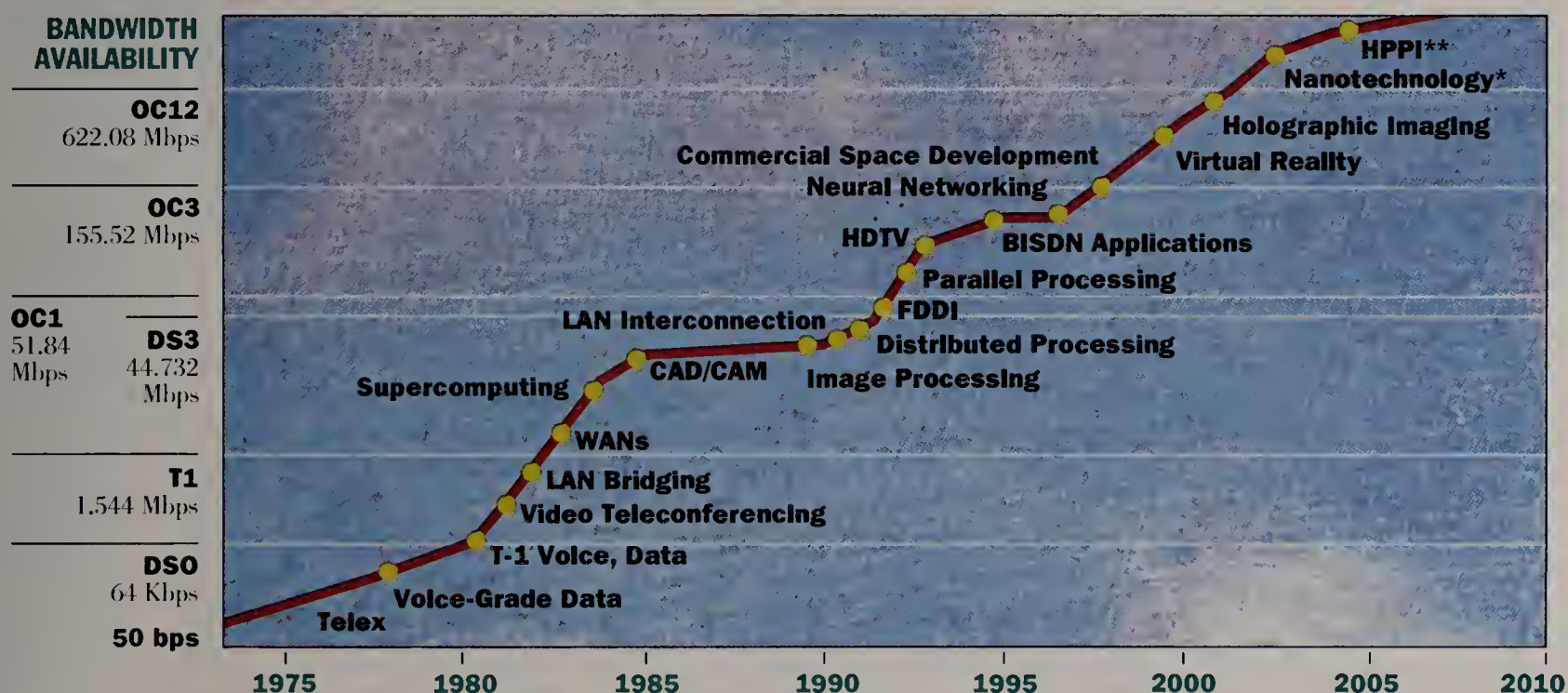
tact with outside networks.

IS organizations will need to look more closely at the necessity of encrypting data and using digital signatures—unique bit patterns that identify the actual sender of an instruction or piece of information—to improve security and authenticity. To date, several standards for digital signatures have been proposed, but none have won out, according to Xerox PARC researcher Ralph C. Merkle.

The importance of network reliability will only increase as networks carry more and more data. "IS organizations will have to reconceive the issues of fault tolerance and recovery," said Mui. **CIO**

The Road To Supernetworking

The steady increase in bandwidth makes it possible to run incredibly complex, data-dense applications over networks



* Nanotechnology: Materials manipulation at the atomic or molecular levels. One potential use would be to provide high-capacity storage for very high-speed networking.

** HPPI (High-Performance Parallel Interface): A set of standards for local-area connections. Enables networking at gigabit rates by sending information in parallel. Now in use for supercomputers, connections for FDDI LANs.

SOURCE: MCI COMMUNICATIONS

SUPERNETWORKING
PROFILE

HEALTH CARE'S BAND LEADER

Minnesota's largest health-care provider is participating in a trial of high-speed, high-bandwidth networking that it hopes will help improve service and cut costs by making accessible to all its physicians the expertise of a limited number of specialists

BY ALLAN E. ALTER

Supernetworking seems a little less like science fiction when a large cost-cutting outfit like Health One starts experimenting with it.

Health One Corp., of Brooklyn Center, Minn., is the Twin Cities' largest health-care provider and the state's 11th largest employer. It is a not-for-profit chain of hospitals, nursing homes and other health-care service providers scattered across Minnesota and Wisconsin.

Like other health-care providers, Health One has been hard-hit by competition and high costs. It operates in an unusually competitive region: Half the population is enrolled in HMOs, and Health One must compete for its patients against three other large hospital chains. It is also deeply in debt: At the beginning of 1991, according to Dun & Bradstreet, total liabilities were three times Health One's net worth.

Health One is responding to these business pressures with closings and layoffs, and by consolidating operations, according

to Dick Blair, executive vice president responsible for administration, finance and information services. In January the organization announced plans to merge with LifeSpan Inc., a competing health-care system of comparable size.

Health One wants to cut medical costs, too, without sacrificing quality or its competitive strategy, according to Alan Abramson, director of strategic computing systems. The organization wants to continue to offer a complete spectrum of medical services to referring physicians and HMOs while consolidating costly high-tech specialties such as heart surgery in a few medical centers. (Its local hospitals will continue to offer standard, less-expensive services like obstetrics and orthopedics.) In order to make specialists in one facility available to practitioners in others, it is turning to supernetworking.

Along with 13 other Minnesota companies, Health One is participating in a trial of high-speed, high-bandwidth networking being run by regional carrier US WEST Communications. (Other vendors involved in the project include AT&T Network Sys-



SNAPSHOT

Health One wanted to cut costs while continuing to offer a complete spectrum of medical services. The company is trying to consolidate many of its costly, high-tech specialties in a few medical centers and use supernetworking to make the expertise of radiologists and other specialists available to all practitioners.

DICK BLAIR: NETWORKING IS A WAY TO BOTH IMPROVE MEDICAL CARE AND LOWER COSTS.

tems, VideoTelecom, ADC Telecommunications, Fujitsu and Siemens Stromberg-Carlson.) The purpose of US WEST's COMPASS (for COMmunications Program for Advanced Switched Services) trial is to uncover practical, cost-effective applications for these networks. Health One will be testing medical-imaging and videoconferencing applications for long-distance radiology and other medical and business opportunities.

With faster transmission speeds, high-quality medical images such as magnetic resonance images (MRIs) and computerized axial tomography (CAT) scans can be transmitted quickly over long distances. This could improve medical care throughout the Health One chain

by making the services of radiologists—the experts who interpret these images—more accessible to all. Health One will be exploring the following applications:

- Radiologists on call for off-hour emergencies will be able to receive medical images at their home workstations in seconds. Emergency-room physicians will no longer need to wait for the image to be delivered to the radiologist's home, or for the radiologist to come to the hospital.
- Physicians in any Health One facility will be able to have their patients' images interpreted by the most appropriate radiologist in the chain. "A specialist [will be able to] do interpretations for many more customers," said Abramson.
- Physicians and radiologists need not be

PHOTO BY STEVE NIEDORF

SUPERNETWORKING

RADIOLOGISTS on call for off-hour emergencies will be able to receive medical images at their home workstations in seconds. And physicians in any Health One facility will be able to have their patients' images interpreted by the most appropriate radiologist in the chain.

together to confer. When a case requires a team of practitioners in different locations to examine an image together, they can do so in their own offices instead of traveling to one site.

- Radiologists will be able to use voice and electronic messaging to instantly relay their analyses. Standard practice has been to dictate reports for later transcription, except in emergencies (when telephones are used).

Health One plans to begin testing home workstations for emergency use and other applications later this year. Radiologists will continue to use dictation equipment, but

Abramson is looking into new ways to provide instant interpretation in emergencies.

This test will utilize switched DS1 services in the form of a standard DS1 or primary-rate ISDN line to obtain the 1.544 Mbps of bandwidth initially required. How much bandwidth will ultimately be needed may depend on such details as the number of pixels on radiologists' screens. "What is high resolution for an IS manager may be unacceptable for a radiologist," said Abramson. "We think a 512-by-512 dots-per-square-inch screen and a 16-pixel gray scale is high resolution. Radiologists talk about 1,024-by-1,024. That gets us into technical ques-

Technology X-Ray

An inside look at Health One's communications infrastructure

Advanced communications development for Health One Corp., a multifacility health-care provider in Brooklyn Center, Minn., is based on a US WEST Communications broadband applications trial called COMPASS (Communications Program for Advanced Switched Services). This program is designed to introduce and evaluate switched broadband services in daily applications.

Health One will be utilizing several network architectures and platforms across bandwidth categories for a videoconferencing application among three locations. Other vendors involved in the project include AT&T Network Systems, VideoTelecom, ADC Telecommunications, Fujitsu and Siemens Stromberg-Carlson.

Multimedia video capabilities will be tested using VideoTelecom free-standing conferencing equipment. The VTC units employ the latest video-industry standard H.261-compatible algorithms, which provide full-duplexed audio and high-resolution graphics capability. Motion-video resolution is achieved through both compression and bandwidth. Using current compression algorithms, full-motion video requires only 384 Kbps.

Health One will initially test switched DS1

(T1) services capable of delivering 1.544 Mbps of bandwidth on demand in the form of a standard DS1 or a primary-rate ISDN line. Later, either SMDS or broadband ISDN services will demonstrate how video communications can be supported by a variety of network services.

The switching technology will employ Class 5 digital central offices and ISDN (both basic- and primary-rate), with the appropriate termination equipment and the use of a network bridge to manage multipoint videoconferencing connections. (This is the first experimental use of a video bridging device in an RBOC network.) This will enable US WEST to build a high-bandwidth pathway for the duration of a video session and break it down at its conclusion, much as with a standard voice call.

Health One and US WEST officials will use the same technology for data transmission among the organization's clinics, physician offices and hospitals. Switched broadband is viewed as a complement to existing dedicated networks for sporadic or unusual data transmissions.

The radiology trial will employ Macintosh or IBM-compatible graphics workstations to receive compressed images for review and consultation. The trial will determine the appropriate use of this level of technology compared to the dedicated but distance-limited equipment currently in use.

tions like compression algorithms and screen refresh rates, and how much bandwidth is practical. That's what we're trying to discover in the trials."

The more Health One centralizes, said Blair, the more essential close relationships and meetings between headquarters staff and field managers will be. Videoconferencing, he hopes, will enable Health One officials to conduct effective meetings without wasting time traveling.

The company will initiate a six-month trial of videoconferencing later this year. Top management will try out the technology first; if the trial is successful, middle management and physicians will become users as well. Executives will be able to transmit spreadsheets, charts and videotapes (of new admissions or medical procedures, for example) directly from PCs or VCRs over the videoconferencing circuit. In the future, said Abramson, the system could be used to link doctors in rural clinics with their Twin Cities colleagues, and for continuing medical education.

While Health One's participation in the COMPASS program will be limited to these two trials for now, Abramson mentioned other supernetworking applications he'd like to see. Just as the transmission of CAT scans and MRIs will help spread the wealth of radiologist expertise, so would real-time video imagery enable other specialists to consult on more cases. And high-speed networks could help medical records and images move more efficiently through the Health One chain, minimizing paperwork and redundant data.

Several factors could prevent Health One from making these experiments permanent. "We may find that some applications are too costly," said Abramson. "We don't know what a good price point would be for us." And while radiologists tend to be receptive to new technology, he said, other doctors may not be—although "most physicians are receptive to anything that can improve the efficiency of their business."

Patients may not be receptive either. "We have no idea how patients feel about these applications, and it's one of the things we'd like to find out," said Blair.

Still, the opportunity to be first with applications that promise to improve the quality of medical care while cutting costs makes the risks worthwhile. 

Band in Boston

Nynex and four Boston hospitals are also running trials of high-speed, high-bandwidth network applications

CHILDREN'S HOSPITAL

Multimedia Medical Records

The nuclear-medicine department is experimenting with multimedia patient reports. These combine medical images, voice and text annotations, and information from the patient's records. These reports will be created by medical-imaging specialists and will be accessible for viewing by other physicians on the network. Another application allows several physicians, viewing the same image from workstations in different locations, to point out features of the image to one another with a cursor. An experimental system using FDDI-based fiber LANs is now running.

NEW ENGLAND MEDICAL CENTER

Online Operating-Room Videos

The cardiology department will be the focus of a trial using video technology. Pictures of patients' heart valves will be transmitted at 30 frames per second over a network between the Center and a referring hospital. These images will be viewable at both sites. The trial was expected to begin by May 1, using T3 circuits running at 45 Mbps.

BRIGHAM AND WOMEN'S HOSPITAL

Physicians' Home Network

This hospital will run two applications for physicians working at their home computers. One will allow emergency-room staff to transmit medical images such as CAT scans and MRIs. Another will enable doctors to rehearse surgical procedures at home as they now do at the hospital, by transmitting three-dimensional, rotatable images of the patient. These applications were expected to be running by May 15.

MASSACHUSETTS GENERAL HOSPITAL

HMO-Hospital Image Transmittal

Mass General is testing an application that enables still medical images to be scanned and digitized at a suburban site, transmitted over a high-speed network to the hospital, and stored in Mass General's picture-archiving system.

The hospital has established T1 and T3 links with the Harvard Community Health Plan's Burlington, Mass., facility.

Links with three other facilities are planned.

—A.Alter

Globalization, organizational change, a culturally diverse workforce—these are some of the things that Wharton Dean Tom Gerrity wants his MBA candidates exposed to. And, oh yes, IT is important too.

THE DEAN'S LIST



PHOTOS COURTESY OF UNIVERSITY OF PENNSYLVANIA'S WHARTON SCHOOL OF BUSINESS

BY
ALLAN E.
ALTER

No man is an island, entire of himself," wrote the poet John Donne. Thomas P. Gerrity, dean of the University of Pennsylvania's Wharton School of Business in Philadelphia, has a corollary: No profession is an island, entire of itself—least of all the IS management profession.

"It is not healthy to view IS as a narrow discipline," said Gerrity. "To be a really effective IS executive or general manager exploiting IT, you need strong general-management and leadership skills . . . similar to those required by any effective business leader."

In his view, students who seek to become effective CIOs or other business leaders in today's world "should follow a broad program in all management functions and disciplines." And that is just what Gerrity and the Wharton faculty hope to provide through their new MBA curriculum.

CIOs know Gerrity well. Before coming to Wharton in July 1990, he founded and served as CEO of the Index Group management-consulting firm in Cambridge, Mass. He became the president of CSC Consulting after the Index Group was purchased by Computer Sciences Corp., and renamed CSC Index. Altogether, Gerrity spent 20 years at Index, advising CIOs and other executives on the strategic role of information technology and on how to bring about organizational change.

Now he hopes to influence an even broader audience by becoming an educator. "I loved being in the business world," said Gerrity. "I loved being an entrepreneur. Yet this [position] presented me with an opportunity to influence not just the destiny of one firm, but thousands of folks year after year. I shook 1,700 hands at diploma time. That's an enormous amount of talent."

IS is just one thread—though an essential one—in the educational tapestry Gerrity and the Wharton faculty are weaving for their students. Call it education for global business leadership. That's short for preparing students for what Gerrity referred to as "the litany"—leader-



THOMAS GERRITY: *Students who want to be effective CIOs should follow a broad program in all management functions and disciplines.*

ship for a fast-changing business world turbo-driven by globalization, organizational change, cross-functional integration within companies, new technologies, complex private/public-sector links and regulations, a culturally and ethnically diverse workforce, *und so weiter* (multilingual too).

"It used to be you looked for that kind of leadership in the leader of very large organizations," said Gerrity. "But as organizations become more decentralized, flexible and innovative, more of that broad-gauge leadership is being asked for in man-

agers at lower levels in the organization, earlier in their careers. MBA programs need to be delivering material related to these skills. Businesses are demanding we produce Renaissance leaders."

In response, Gerrity inaugurated a pilot MBA program that was developed by Wharton faculty and students. Wharton's MBA catalog touts it as "the most significant advancement in management education in 30 years." But Gerrity insisted this pilot does not radically break from the "fundamental core values" of ex-

isting MBA programs. Nor is it a reaction to recent articles questioning the value of the MBA degree—doubts that Gerrity dismissed as "pure poppycock." (The rise in in-house training and education is "a very healthy response to the demand for imparting new knowledge, but it is not a replacement for an MBA," he said.)

The pilot program, whether it proves successful or not, is a clear statement of direction for business education. The program is global and interdisciplinary ("integrative" is the



GERRITY, as an academic dean, can "influence not just the destiny of one firm, but thousands of folks year after year."

word Gerrity used) in substance and style. Basic disciplines are team-taught by faculty members from several Wharton departments, in order to bring a cross-functional perspective to traditional subjects such as marketing and finance. Spending four weeks in East Asia or Western Europe to witness foreign businesses in action is mandatory. Courses in organizational design, risk and crisis management, teamwork and innovation are being added to the catalog.

Students are also required to take a year-long "Leadership Skills Course," which, said Gerrity, "introduces leadership, communication, self-assessment, negotiation and management skills, and ethical values—all within] the context of managing a diverse workforce across business functions and national boundaries." In this course, students form teams designed to reflect a mix of genders,

"Businesses are demanding we produce Renaissance leaders."

—Thomas Gerrity

—
races, national origins and functional differences.

Where does the IS function fit into all of this? Wharton's MBA programs, new and old, offer a major in management information systems. But since the business changes that shaped the new MBA program also affect IS executives, CIO wannabes need the same integrative education as other executives. The flip side is that since IT and IS are among the forces driving change, any

MBA student who hopes to succeed in the 21st century needs solid schooling in IS.

"We want MBA students to understand the obvious: Information technologies are very important strategic tools and weapons," Gerrity said. "And we want them to have some sense for the real issues that need to be managed in order to successfully derive that strategic benefit, [to spot] those benefits, and to avoid the risks and pitfalls." In addition to the strategic side, IS and IT should be understood from a functional perspective—how they are deployed in the "various functions of business," such as marketing.

Gerrity criticized IS-related courses that are overly technical. "Technology provides useful background, but the really useful issues are the relationships between technology and business applications," he said. According to Gerrity, the most impor-



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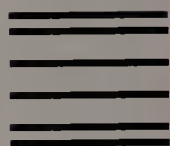
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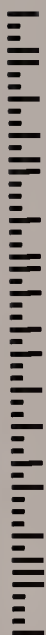
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tant questions to examine concern the linkage between IT and business value, and the process of changing human behavior in order to gain business value. "That's where the strategic view and the business-function view help."

Ironically, teaching IS is an especially tricky educational task because it is the interdisciplinary discipline par excellence. "We sometimes treat IS as one discipline, but it's not," said Gerrity. "IS is very multifaceted. There is no function that touches the organization more intimately and at every aspect, from nitty-gritty operations to the global strategic level. It interfaces with marketing, production, R&D laboratories, executive offices, strategy, accounting and finance. It touches on every time frame, from immediate operational activities to long-term strategy. That makes IS a unique animal.... I think we are still grappling with effective ways to teach IS."

The curriculum and pedagogy of the new MBA program will undoubtedly change—since it is, after all, only a pilot. (Fewer than 20 percent of incoming full-time MBA students participated in the curriculum this year.) But so far, Wharton is offering a four-pronged approach to IS enlightenment.

"We want MBA students to understand the obvious: Information technologies are very important strategic tools and weapons. And we want them to have some sense for the real issues that need to be managed in order to successfully derive that strategic benefit."

—Gerrity

First, the new MBA program continues a 10-year-old trend in Wharton's traditional program to include IS management issues in core classes. The course on marketing, for example, discusses the use of point-of-sale scanner data by supermarkets and retailers.

The curriculum also includes courses on specific IS themes. One that

is required is a class on "Operations Management: Strategy and Technology." And there are some IS-related electives: "Technology for Managers," which focuses on managing technological innovation and integrating new technologies with corporate strategies, and "Information: Industry Structure and Competitive Strategy," which examines the competitive implications of IT and strategic and systems planning.

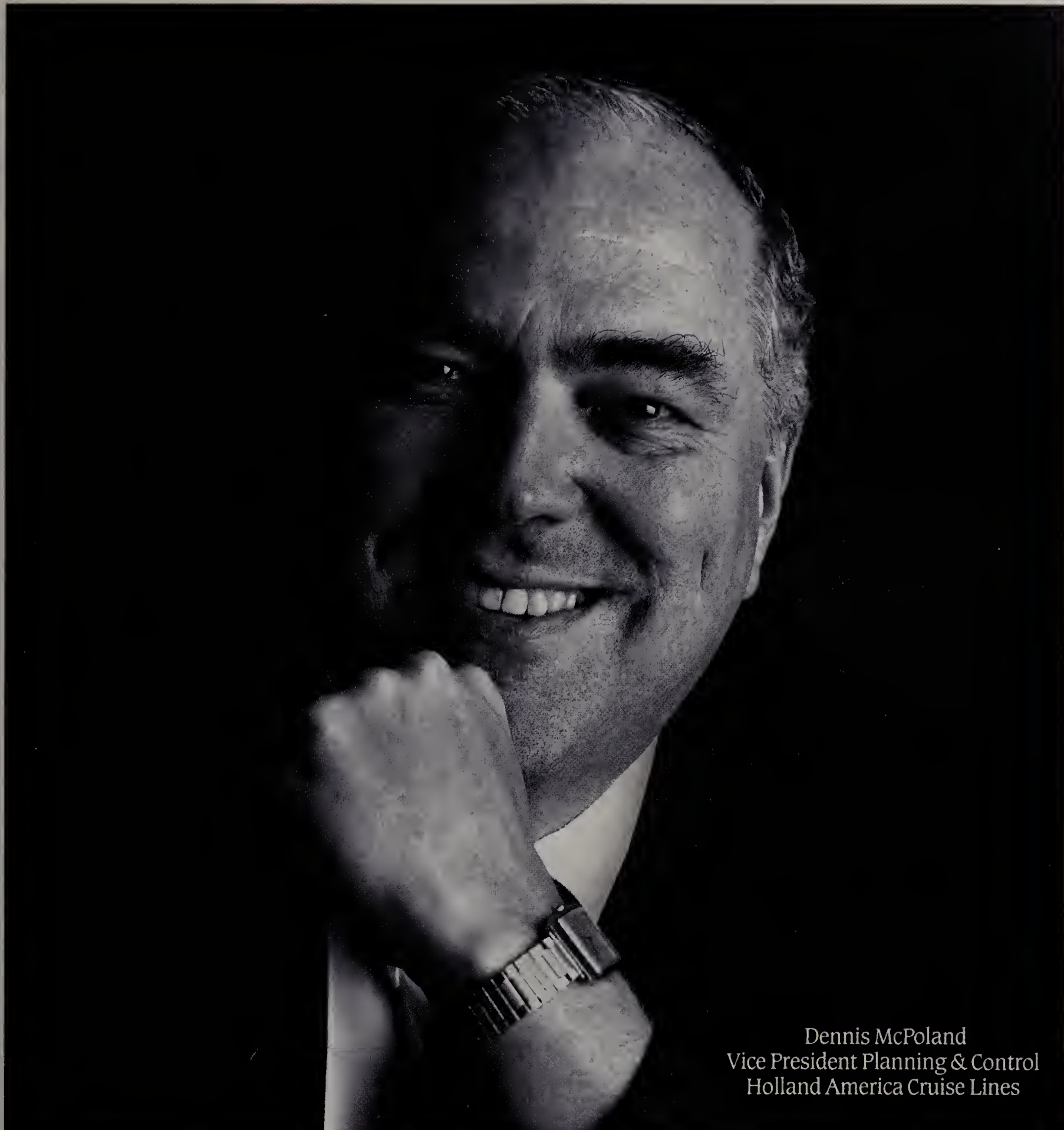
Other courses help build an understanding of the deployment of information technology. A new elective on risk and crisis management, said Gerrity, "focuses on how to manage risk in the course of managing change." Gerrity also expects that courses on entrepreneurship, innovation and managing change, among others, will help students manage technology.

Finally, students have ample opportunity to use information technology. Personal computers are de rigueur for Wharton MBA students. Faculty are learning to create multimedia presentations at the school's pilot multimedia center. But perhaps the most advanced users of IT among Wharton's student body are those enrolled in its executive MBA program for students who work full time. A wide area network links these students' home computers with those of other students and faculty members, allowing them to send spreadsheets, reports and E-mail messages to professors and peers alike.

Whatever the fate of the new MBA program, odds are that Gerrity will lead Wharton into the 21st century. This youthful-looking and energetic man is only the 11th dean in Wharton's 110-year history (and only the second to come from the private sector rather than academia). The school makes a fine fulcrum from which to move the business, academic and—even after leaving Index and CSC Consulting—IS worlds. For "managing across both functional and cultural differences, as well as across ethnic and national differences . . . are the same skills that IS people find they need to introduce technology-related change in organizations." CIO



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FRONTLINE



BY PORTIA ISAACSON

IT to the Front, Please!

THE SHIFTS GO ON . . .

Paradigm shifts are the watchword of information technology. Until the mid-1980s, Grosh's Law—"The Bigger, the Better"—ruled computing. We struggled with large, costly, inadequate beasts in the back room and beat our chests as we delivered reams of computer printouts.

Printouts gave way to dumb glass tubes on the desks of the computer unwashed, but the corporate data remained centralized safe. Then Steve gave us Jobs's Law—"One Person, One Computer." In the wake of chaotic desktop-computer deployment—where job descriptions, skill requirements and even whole business visions have changed—we wonder if we are corrupting forever a precious corporate resource as our centralized reservoirs of information drain out into uncountable, uncontrollable point-to-point connections.

Now that we have a computer on nearly every desk, we wish IT would settle down while we distribute and connect. If only IT would be still, maybe we could actually reengineer a few tired old corporate processes or, better yet, build the ultimate IT-enabled strategic advantage.

But IT will not be still. Semiconductor-based products and services run amok with price-performance improvements compounded exponentially by layer upon layer of systems. We stand at the threshold of frontline computing. . . .

Frontline IT will not be tied to the desk by wires

and weight; it will be carried and worn. Desktop, briefcase, purse and pocket IT will become as commonplace as paper pads. Maybe we'll have Portia's Law: "Relatively Free, With-the-Person IT." Frontline IT is arriving just in the nick of time if we are going to stop merely evolving and really reengineer our businesses.

If you think you know IT now, better look again. This is not an evolution.

The Big Picture

YOU HAVEN'T SEEN THE LAST OF RE-

Reengineering. A simple idea, but not simple enough. No idea is simple enough until you find the one truth that, once found, seems obvious and from which details, clarifications and decisions flow easily. If you can't put it on a T-shirt in big block print, try again. Simpler ideas are found by thinking bigger, not smaller.

Einstein's beacon was simplicity as he searched for the ultimate physics paradigm. Although he never completed his beloved Unified Field Theory, he created unfathomable value for mankind while pursuing his vision.

If physics, the mother of engineering, may have one equation from which all else follows, why not business? And why not your business? Humbly, I put before you a rough draft of Portia's Unified Business Theory: The sum of people and IT in the enterprise equation represents a holistic or systems view of the enterprise structure. In the coming frontline IT paradigm, IT's primary function is to empower indi-

viduals with the information and tools they need for lean—as opposed to mass—production. Workers will be released from the repetitive prison of small jobs in incomprehensibly complex factory or office assembly-line processes. New-generation workers who are generalized, multiskilled, always improving and IT-empowered will focus on the value being created for customers.

To attempt reengineering without first re-paradigm- ing would be foolhardy. A para-

paradigm is a framework of assumptions, beliefs and theories (the laws of physics, for example) that provides the context for engineering. Could one reengineer the Starship Enterprise with its warp drive, holodecks and transporters from today's Boeing MD-11? Not without first re-paradigm- ing scientific theories.

Neither will your enterprise be properly reengineered if your business paradigm is wrong or your IT paradigm is archaic. What are and will be the basic truths of your business? What are and will be the basic truths of IT now and five to 10 years from now? Re-paradigm, then reengineer.

The CIO's re-paradigm- ing job is more challenging than a physicist's. Most physicists believe that the laws of physics do not change with time. The CIO's laws of IT, however, change with each relentless improvement in semiconductor technology, and about every 10 years a paradigm shift rattles every belief about IT and its economics. Not only must the CIO create a new paradigm

What are and will be the basic truths of your business? What are and will be the basic truths of IT now and five to 10 years from now?



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FRONTLINE

before reengineering, he or she must define a paradigm for each year (or month or day) in the future that the enterprise is to fly.

After you have defined a business paradigm for each year and are particularly sure of your IT function/price forecast, it will be time enough to reengineer the business. You don't have to be a rocket scientist to notice that the basic tenets of reengineering sound like sections from a CIO's handbook:

- Organize around outcomes, not tasks.
- Have those who use the outcome of the process perform the process.
- Subsume information-processing work into the real work that produces the information.
- Treat geographically dispersed resources as though they were centralized.
- Link parallel activities instead of integrating the results.
- Put the decision point where the work is performed, and build control into the process.
- Capture information once and at the source.

In his landmark article in the July/August 1990 *Harvard Business Review*, Michael Hammer told us to think big and to have vision—basic requirements for CIOing. Sounds familiar. Frontline IT and reengineering are made for each other. Perfect timing. In this column, you haven't heard the last of re-

IT Now and Then

FAX DOES WHAT?

Fax is now universal worldwide business mail. Computer-based fax, still in its infan-

cy, enables us to glimpse our faxamation future.

"Faxamation" is the word I would use to replace the limiting term "computer-based fax." We are moving eons beyond emulating fax machines on personal computers to faxamation applications that exceed our wildest electronic paper dreams. TeleForm, from Cardiff Software, was my pick for faxamation "possibility thinking" in 1991. TeleForm enables entering data into a PC from a paper form through any fax machine. The data is recognized and encoded when the fax is received on the personal computer running the application.

No keying! Great for order forms, product-information-retrieval forms, remote payroll records, surveys and product registrations.

The pace of faxamation innovation is picking up now that standards are solidifying for fax modems (check Intel). Soon the number of fax modems in use will soar because all new PC modems will have fax capability at no additional cost.

My pick for the most innovative faxamation application to date is Xerox's PaperWorks (see Trendlines, *CIO*, April 1, 1992). PaperWorks is a PC-based document (fax image) storage-and-retrieval system that enables storing, retrieving and distributing documents from any fax machine using only a paper form. It turns paper into a not-so-dumb, very inexpensive and lightweight terminal. No computer required, except for the PC base station back at the office. From anywhere in the world, using only a paper form and a fax machine, you can submit pages for storage, retrieve copies of

The cost of long-distance fax is about 10 cents a page—not much more than copier costs and certainly less than overnight air for under 30 pages.

There are about 500 notebook computers in a ton.

pages that are stored, and distribute copies of any stored document or any document attached to the form to anyone with a fax number.

Xerox PARC—which gave us the user-friendly PC GUI first demonstrated on the Xerox Star—just might be onto something even bigger with PaperWorks (and I hope more profitable for Xerox).

The Latest Fashion

WEARABLE COMPUTERS

GRiD, the pioneering portable- and pen-computer Tandy subsidiary, has given us the first computer positioned as wearable. Definitely more Levis work clothes than Armani, the wearable GRiD embodies some really practical ideas: for instance, batteries on the belt with pen computer on the wrist to reduce the weight for workmen atop utility poles.

Someone told me recently that they hold the patent on the badge computer (à la the *Star Trek* communicators). Now, who was that, when can I get one, and what color do I want?

Buying IT

HOW ARE YOU BUYING DESKTOP AND PORTABLE COMPUTERS?

If your company is still buying through personal computer dealers, it's time to review your options. Before you delegate this review, consider that few decisions are more strategic or have greater impact than how you support your frontline employees in their use of desktop and portable computers. Ride the truck: Go talk to a few end users.

Portia Isaacson's Pen-Computing Workshops

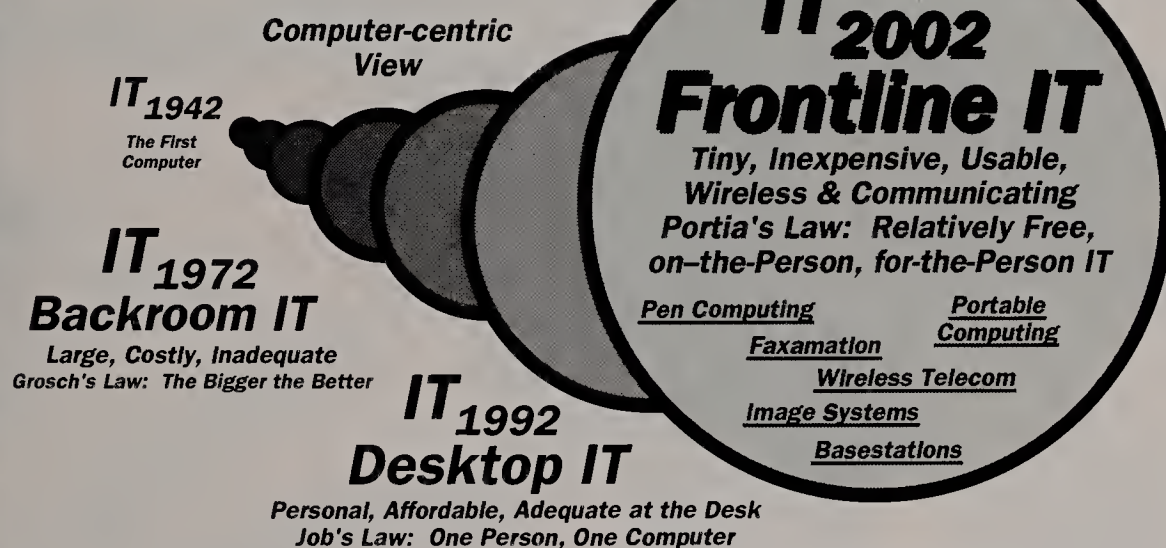
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The man with too many yo-yos.

So you're in charge of information systems, usually, for this sprawling operation with hundreds of locations in faraway places populated almost exclusively by people who, hopefully, are better at their jobs than they are at using PCs to communicate back and forth with the home office, plus a growing gaggle of near-impossible-to-support mobile users, when this "Memo" from the corporate stable of Harvard prodigies with perfect teeth hits your desk with an ominous thud and a casual mandate that you whip this puppy into a "networked electronic enterprise" which, translated, means info on yesterday's operations consolidated and delivered to every manager's PC by 8:00AM their time, no matter where it is (whoa!), using forms-based workflow to and from central site SQL databases, not to mention ad hoc query capabilities for those mobile PCs, electronic ordering from suppliers and the electronic delivery of text and graphics-based order forms and catalogs direct to your customers' PCs, all of which raises the specter of homebrew polling solutions and the agony of long-term support for in-house-developed applications, and you start to feel that bad kind of sweat making an executive form of diaper rash around the inside of your collar right up until you decide to take a closer look at that RemoteWare™ proposal from XcelleNet® which was specifically designed to tame your yo-yo-like network via communicating applications that use low-cost, occasional connections over all kinds of telecommunications facilities, and are created and delivered electronically to remote and mobile PCs by operations managers without adding to the already-nasty programming load of your beleaguered staff and sparing acres of innocent rain forests from unnecessary slaughter, so you call the XcelleNet guy and he's calm so you're calm and you route your polite "I'm way ahead of you" response back to Mr. Ivy League MBA, and that's when you get this amazingly complimentary call from the boys on the Board....and they want to make you president or something.

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FRONTLINE

If yours is a large organization, it probably has more personal-computer end users than your internal support staff can hope to serve. Consider using your in-house support staff for company-specific applications and leaving the support of such standard products as

word-processing and

spreadsheet packages to outside firms that offer higher quality and more efficient support than most dealers are able to provide. Few local dealers have the critical mass to offer telephone-based support for large numbers of end users spanning a broad range of hardware and software products.

The best support from outside firms today is provided by those with centralized, nationwide telephone hot lines. The best have at least 40 supporters backed by specialists in hundreds of commodity products; these in turn are backed by specialists in the computer, peripheral, network and software companies whose products are being supported. Some support centers are available to end users 24 hours every day of the year from anywhere there is a telephone. The best support centers solve the end user's problem no matter what it takes and frequently at no cost if the computer was purchased from them.

How do companies like Dell Computer give away such high-quality lifetime support? Simple. Dell sells direct, primarily over the telephone, and doesn't bear the cost of a too-independent distribution channel or a costly blue-suited direct sales force. Others have followed no-blue-suit with their own versions of what I call sup-

The best support from outside firms today is provided by those with centralized, nationwide telephone hot lines.

port-centric, mail-order direct. The latest is Desktop Direct from Digital Equipment Corp.—the first such foray by a leading computer maker.

Dell responded to end users. Others have followed. Now DEC. (Of course, DEC had few dealers, so launching support-centric, mail-order direct was painless.)

Will the dealer-dependent manufacturers follow? Will you demand it? Even from IBM, Apple and Compaq? From the manufacturer's point of view, support-centric, mail-order direct is an efficient way to interface with huge numbers of customers, offering easy access to market research and account control of the highest order.

Mail-order direct also coincides with the principles of lean production, since it enables manufacturing-to-order and minimizes inventory in distribution channels—providing savings that can be passed on to customers.

Stay tuned. The best support, if you want it, is yet to come.

Cheering and Jeering

WORK'S A TRIP WITH A PEN

Most folks walk away from demos convinced that pen computing is inevitable. If you haven't already, check out demos by GO, Slate and Microsoft. In the past few months I've witnessed spontaneous cheers from packed auditoriums. I've also heard jeers from irritated volume-purchasers because the products they really want are not available at the price they're willing to pay.

Both cheers and jeers spell inevitability. If you start

your pen-computing evaluations and pilots now, you'll be ready for deployment when the products are ready. Don't wait. My company's research with hundreds of large organizations shows that portable IT has enabled companies in virtually every industry to pilot or deploy frontline applications. Pen computing will accelerate this trend. Smart reengineering frequently reveals payback opportunity measured in months, not years. When has IT been so easy to justify?

There is a safe and inexpensive way to explore the value of pen computing to your company. If yours is like most companies, in 1992 you are purchasing tons of keyboard notebook computers (TI WinSX and BCC Avanti, to name two). By paying a little extra, you can opt

for a full-featured keyboard notebook that also has a pen interface. It will run all your standard DOS and Windows applications as well as Windows for pen-computing applications such as Word, On-Time and DayTimer Personal Scheduler.

The NEC UltraLite SL/20P with Microsoft Windows for Pen Computing is my dream machine this month. On the road I do my real work with Word and On-Time while dreaming with pen. At my fingertips is today and at my pen tip is tomorrow. The best is yet to come. ☐

Portia Isaacson is president of Dream IT Inc., a Cambridge, Mass., consultancy, publisher and workshop producer dedicated to providing quality information to customers and creators of frontline IT.

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The Objective Approach

Object-oriented techniques are proving to be quite effective for developing standard corporate applications. But the real demand for OO technology will explode when companies start to tackle the next, radically different generation of applications.

BY DAVID FREEDMAN

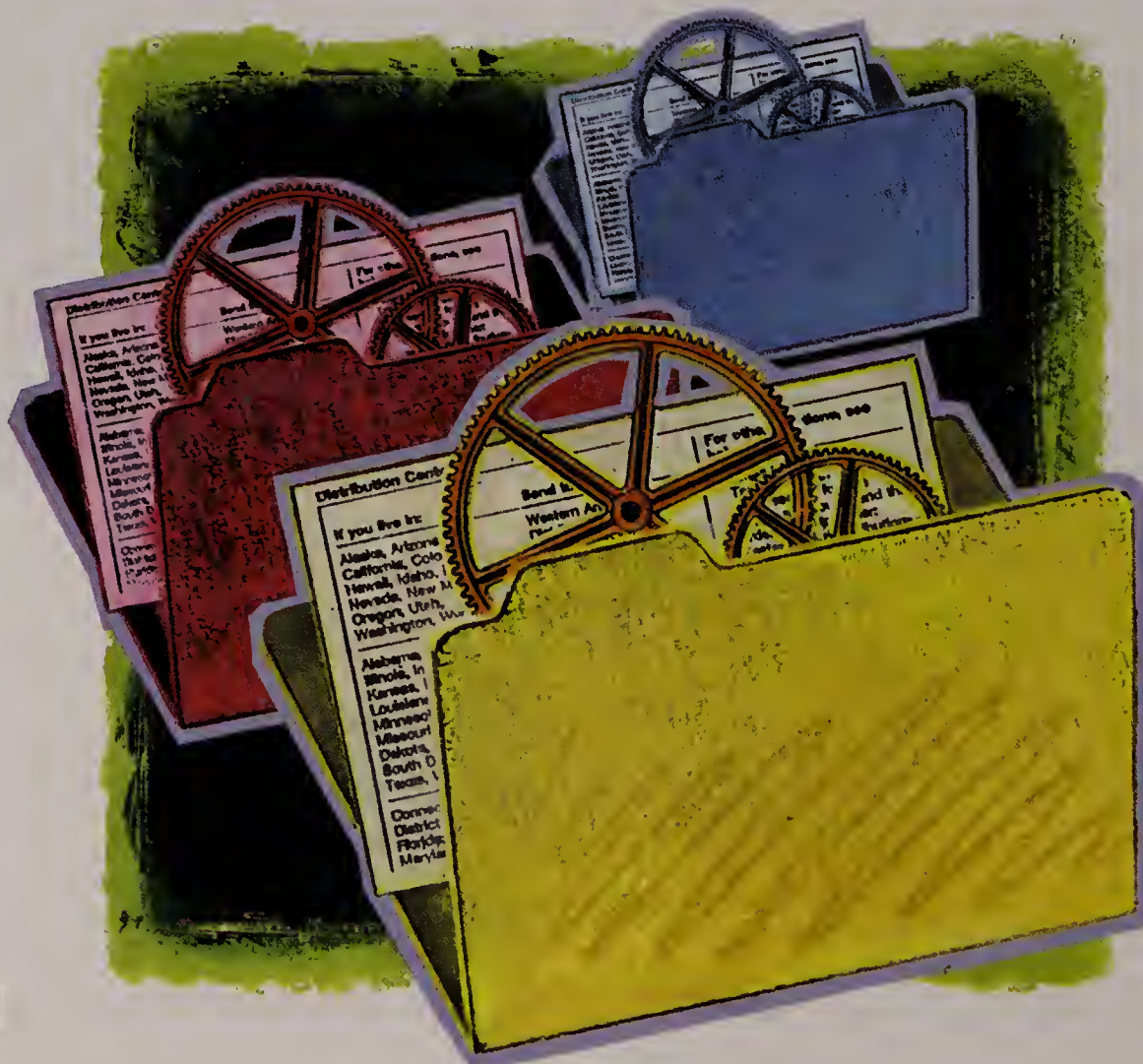
There are two salient features of the object-oriented (OO) approach, which can be applied separately or in one fell swoop to programming, operating systems, database-management systems, and analysis and design. The first key feature is "encapsulation," or the bundling of data with the programs that manipulate it into a single "object." Because every piece of data is attached to programs that can translate it into a form acceptable to a particular application, no matter what form the data is in—be it tables of numbers, free-form text, video images, audio recordings, or any combination—applications can treat it as if it were just a generic block of data like any other. "Data and programs by themselves are passé," insisted Al Fung,

an OO guru and president of software development and consulting firm SoftFab International in Cambridge, Mass. "Objects are in."

A simple example of this approach is the icon-oriented interface popularized by the Apple Macintosh computer: No matter what the format or content of a file, it is represented on the screen as an "object" that can be moved to different directories, clicked on or stuffed in a "trash can." Different files may actually have to be treated quite differently by the computer when they are clicked on, but you usually don't have to worry about that; typically, the program needed to deal with that file is automatically called into play at the right time.

Keeping each piece of data intimately linked to the programs that use it means that application developers and users only have to specify what they want accomplished—not how the system is supposed to accomplish it. Computers are still way behind other common appliances in providing this sort of don't-sweat-the-details operation, said Fung. Even to do something as simple as share a word-processed document with another computer user, you first have to make sure you're providing the appropriate file format and diskette size—types of questions you never have to ask of, say, a video-store clerk when you rent a movie. "We want systems that will work like a VCR," said Fung: "You just press play and sit back and watch the movie. You don't have to tell the machine how the movie was filmed."

The second key feature of the OO approach is inheritance, which allows developers to define a broad class of objects—say, for example, "employees"—and then to have more specific "instances" of



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this class, such as management employees and union employees, which can in turn have their own instances, such as full-time union employees, part-time union employees and so forth.

When building a system, the developer only has to specify the attributes for employees as a whole. The different instances automatically inherit all the attributes of their "parents," except when the developer specifically points out differences. Thus the system can be told that "employees" receive full benefits packages, and it will assume that's true of all the different instances of employees. It only needs to be told when that's not the case (for instance, part-time union employees receive only partial benefits packages). "It's programming by exception," explained Mary-Jane Monks, a technical education consultant and OO missionary at AT&T in Piscataway, N.J., whose IS group is now starting its second pilot OO-based system.

The combination of encapsulation and inheritance is a powerful one, providing two major benefits right off the bat: code reusability and the means for quickly making changes. Code reusability is a much-desired goal that has eluded software developers for years, thanks to the difficulty of figuring out how a completed program can be broken down into neat chunks that can be mixed and matched into new programs. But object-oriented applications are created in such chunks—the objects themselves—to begin with. "The main advantage to object-oriented thinking is the ability to create a library of reusable parts," said Peter B. Privateer, vice president of strategic product planning for CASE vendor KnowledgeWare Inc. in Atlanta. "Objects make good parts because they have clearly defined behaviors and interface points." As a result, software developers don't have to worry about them doing something unexpected when they are placed into a new program.

AT&T's Monks values OO-based systems' affinity for modification. "We obtained the real benefits from our first pilot when we sat down to make

*"Data and programs
by themselves are
passé; objects
are in."*

—Al Fung

a major enhancement to the system," she recalled. "Because of the way objects inherit changes, we were able to bring them up in a much faster time frame."

But even these significant benefits are not enough to justify asking IS departments to jump with both feet into the object-oriented world just yet, Monks and Privateer agree. For one thing, it's too new an approach on which to risk major projects.

The real demand for OO technology will explode when companies start to tackle the next, radically different generation of applications, said Fung. "Up until now, we've been forced to adapt to computers' limitations," he explained. "From now on, users are going to expect computers to adapt to them, through applications that are easy to use. But developing easy-to-use software requires a tremendous amount of work, and that's causing a crisis in software development. The only way to manage the complexity is through object-oriented development."

One aspect of this new trend in applications is the growing demand for integrated speech and images to bring computers in line with the way people communicate and think, said Fung. OO techniques are already widely known to handle that chore far better than conventional software. With the image- and voice-processing programs built into the objects themselves, systems won't have to wrestle with special ways of dealing with each type of data.

But a more general and fundamental advantage, insists Fung, is the way that OO technology can strip away the artificial structure that conventional software design has imposed on information. "When we want to store information on a computer

now, we have to break it down into words, tables and records, and when we retrieve it we have to restructure all that data back into a form that we can make use of," he said. "It's as if every time you went to park your car, you had to rip it apart into all its component pieces and then reassemble it later when you wanted to drive it again."

Because OO-based systems are able to represent the world much as we perceive it—as objects of various types that have certain behaviors—they allow people to make more convenient and effective use of information, said Fung. For example, accessing and modifying information about an employee in a personnel system often requires navigating through various forms and procedures, he said. Wouldn't it be a lot easier if you could just click on, say, an icon representing the accounting department, and have photographs of all the employees in accounting pop up? Transferring someone from accounting to marketing might just be a matter of clicking on that person's photo and moving it to the icon representing the marketing department. "When we walk down the hall and see the CEO talking to the vice president of sales, we don't picture org charts and records," he said. "An object-oriented system can have an object that represents the CEO and an object that represents the vice president of sales, and these objects are self-contained entities that have attributes just like the people do. That more closely models reality, which translates into making things easier to deal with."

In time, said Fung, that sort of approach will be extended through all aspects of a system, so that software developers will be able to construct, enhance or modify systems as easily as a Windows user can copy a file. "The overriding goal of all software development efforts should be to make things easier for humans," he said. If OO-based approaches can do that, then what's everyone waiting for? ☐

David Freedman is a freelance writer based in Brookline, Mass.

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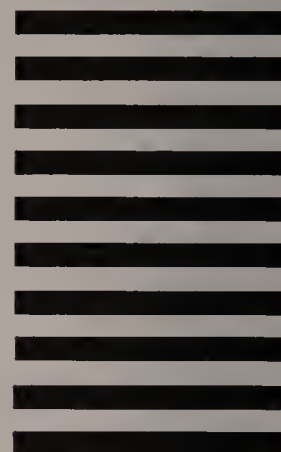
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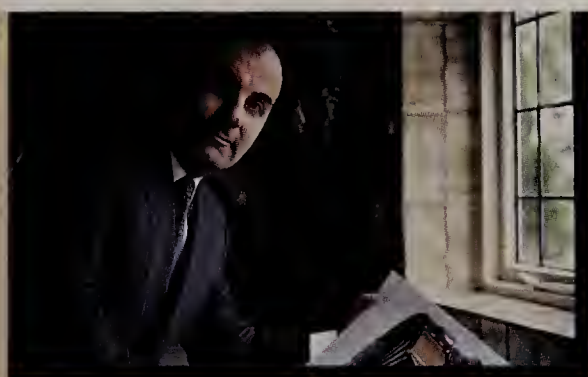
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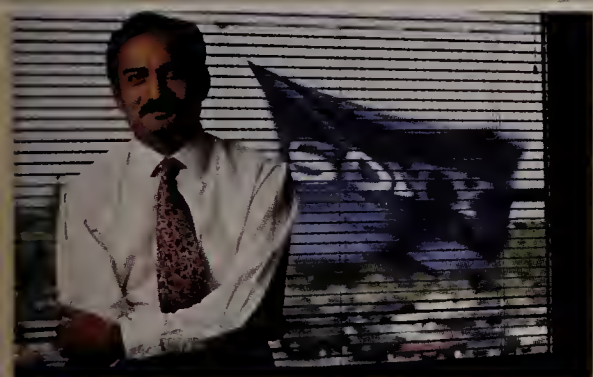
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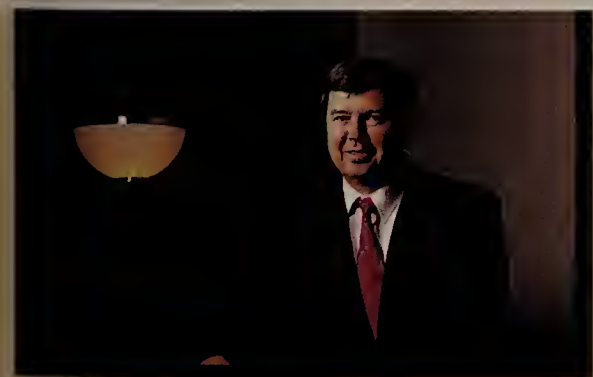
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Bill Palm
President, Canadian Technology Services
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Director, Systems and Programming
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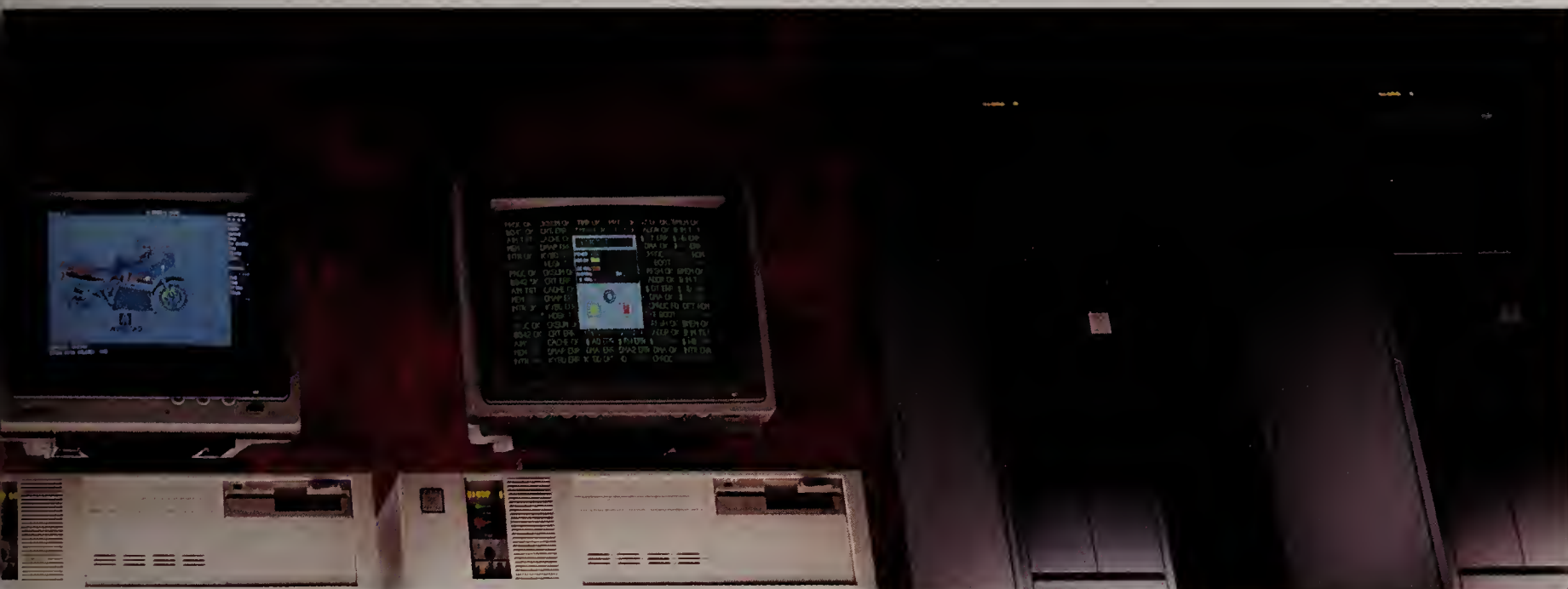
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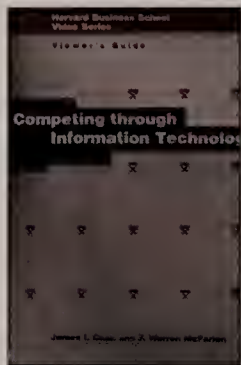
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OFF THE SHELF

COMPETING THROUGH INFORMATION TECHNOLOGY

Featuring James I. Cash Jr. and F. Warren McFarlan
Harvard Business School Video Series (Cambridge, Mass.), 1989
150 minutes, \$2,000



Competing Through Information Technology, a video from the Harvard Business School featuring business and technology gurus James I. Cash Jr. and F. Warren McFarlan,

was produced in 1989—an age ago by IT standards. Nevertheless, the lessons it teaches and the questions it raises are still pertinent to any company looking for new ways to use IT for competitive advantage.

Aimed at “senior vice presidents of competitiveness,” the video of-

fers to open the eyes of any executive. The strategic overview establishes guidelines for determining whether a company's use of IT is support-oriented or strategic and emphasizes changing attitudes toward IT in a changing business environment. The second segment examines the impact of technology on organizational structures, with studies of some well-known organizations—Frito Lay, Otis Elevator, Mrs. Fields' Cookies—that have reorganized around supporting their business with IT.

Part three looks at the interorganizational impact of technology—the ways that companies use IT to deal with their customers and suppliers more effectively. Segment four explores the concept of IT-based strategic alliances, from “blocking coalitions” such as airline-sponsored credit cards that give customers frequent-flier miles for every purchase, to

“defensive coalitions” that help small companies band together to act like one big company.

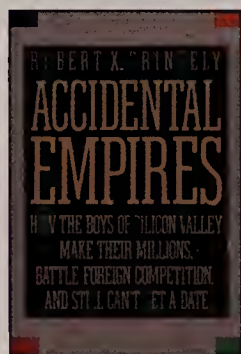
The fifth section suggests methods for determining the risk of individual projects, including a yardstick for “dumb ideas”; the sixth describes an ideal corporate innovation model and looks at inhibitors of innovation. The video concludes by posing five questions that executives must ask themselves every year to determine whether they are using IT competitively.

The 150-minute program is always meaty and interesting. Cash lectures formally and sticks to business case studies, while McFarlan's deadpan delivery is strangely reminiscent of the late Ed Sullivan.

The \$2,000 package also includes a users' manual, viewers' guides, and *Harvard Business Review* articles that provide background on some of the companies mentioned in the video.

ACCIDENTAL EMPIRES How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, And Still Can't Get a Date

By Robert X. Cringely
Addison-Wesley Publishing Co. Inc.
(Reading, Mass.), 1991
324 pages, \$19.95



The just-a-little-too-cute subtitle might tempt browsers to expect something glib, arch, possibly superficial, but *Accidental Empires* turns out to be an insightful, serious

and often profound retrospective look at the genesis of the microcomputing industry.

Perhaps the signal distinction of the pseudonymous Cringely (industry gossip columnist for *CIO*'s sister publication, *Infoworld*) is that his book does what a very good history ought to do: makes credible sense of far-flung events that seemed chaotic, baffling and frequently bizarre at

the time they were occurring.

What Cringely brings to bear on this challenge—besides a smart, entertaining writing style—are his appreciation of and insight into the techie's art, and his understanding of the sometimes-eccentric personalities involved (he is a gossip columnist, after all).

For example, we get a largely unflattering psychobiography of the self-obsessed, monomaniacal Microsoft chairman, Bill Gates III, who comes across as greedily ambitious, petulant, narcissistic and infantile. He also comes across as an inspired programmer, marketer and riverboat gambler, who didn't flinch when it came time to sign one of IBM's justly famous nondisclosure agreements. We get, too, a portrait of Lotus Development Corp. founder Mitch Kapor as the guilt-ridden creator of 1-2-3, for whom the creation seemed too easy to warrant the fortune that it brought him. Writes Cringely: “Mitch Kapor has scruples, and he's needlessly suffering for them.”

We also get especially clear explanations of why the fruits of tech-

nical genius—the best possible hardware or software innovations—don't necessarily become, or even deserve to become, marketable products. A chapter on Xerox's fabled Palo Alto Research Center—where many of the key innovations (Ethernet) and world-class geniuses (Bob Metcalfe, Alan Kay, George Simonyi) of microcomputer history were nurtured—reveals that even the deft administrative hand of Bob Taylor was not enough to overcome a fatal lack of understanding of what makes a product a product. In 1973 the PARC geniuses invented the Alto, the first practicable PC—practicable except that, as Cringely notes, the parts alone cost \$10,000 and the computer would have had to sell for, oh, about \$25,000 1973 dollars.

Yet these, and others, were the emperor “nerds” who went on to found the accidental empires of the PC industry. The individual empires may have been accidental by Cringely's lights, but the book makes clear that the larger, still-evolving empire of microcomputing has always been both fascinatingly coherent and inevitable.



I N D E X

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Editorial, Advertising and Business Offices: 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208-(508) 872-8200. **Postal Information:** CIO (ISSN 0894-9301) is published monthly; and semimonthly in April, May, June, September, October and November by CIO Publishing Inc., 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208. Second-class postage paid at Framingham, MA, and at additional mailing offices. **Reprints:** Copyright 1992 by CIO Publishing Inc. All rights reserved. Reproduction of material appearing in CIO is forbidden without written permission. Send all reprint requests to Permissions Editor, CIO, 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208. **Photocopy Rights:** Permission to photocopy for internal or personal use or the internal or personal use of specific clients is granted by CIO for users through the Copyright Clearance Center (CCC), provided that the base fee of \$3.00 per copy of the article, plus \$.50 per page is paid directly to Copyright Clearance Center, 27 Congress Street, Salem, Massachusetts 01970. Please specify: ISSN 0894-9301. Permission to photocopy does not extend to contributed articles followed by this symbol: \$. **Microfilm:** CIO issues and articles can be purchased on 16mm and 35mm microfilm and on 105mm microfiche through University Microfilms International, Serials Acquisitions Department, 300 N. Zeeb Road, Ann Arbor, Michigan 48106. **Subscriptions:** Address subscription inquiries to CIO, 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208 or call (800) 788-4605. CIO is distributed free of charge to qualified top information executives. To all others, the one-year basic rate for the U.S. and Canada is \$94. For rates to other countries, please write the publisher. The single copy price is \$7. All subscriptions payable in U.S. funds only. Please allow four to six weeks for new subscriptions to begin. **Change of Address:** Please allow four to six weeks for change of address to take effect. **Postmaster:** Send change of address to CIO, P.O. Box 489, Northbrook, Illinois 60065-9816.

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